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Best conditions for your success

Operating Manual

APT.line™ VDL (E2.1)

Safety vacuum drying ovens for material containing organic solvents

with microprocessor program controller RD3

Model	Art. No.
VDL 23 (E2.1)	9030-0038, 9130-0038
VDL 53 (E2.1)	9030-0039, 9130-0039
VDL 115 (E2.1)	9030-0040, 9130-0040

BINDER GmbH

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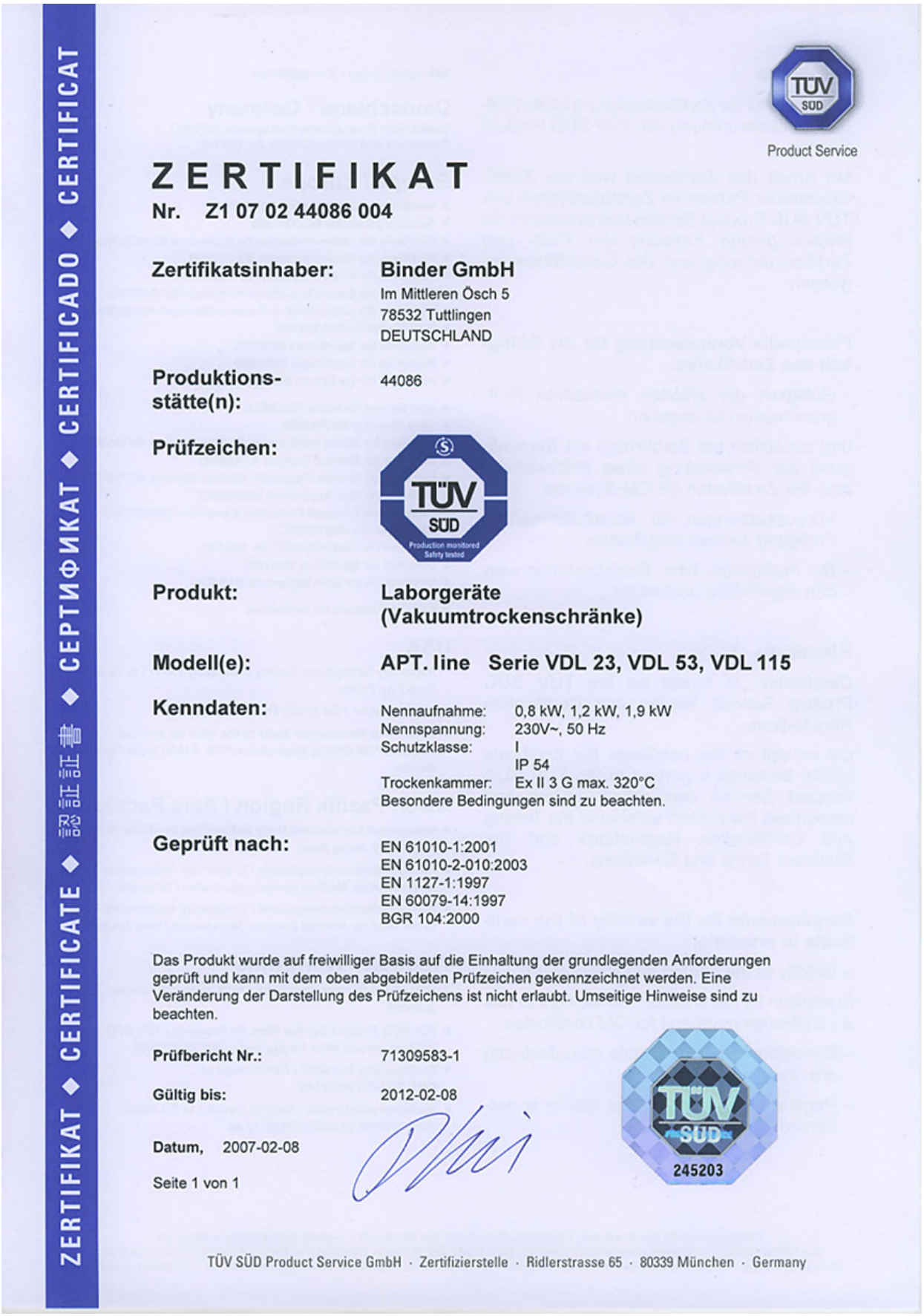
Issue 10/2011 Art. No. 7001-0124

TÜV Certificate



ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

ZERTIFIKAT

Nr. Z1 07 02 44086 004

Zertifikatsinhaber: **Binder GmbH**
Im Mittleren Ösch 5
78532 Tuttlingen
DEUTSCHLAND

Produktions-stätte(n): 44086

Prüfzeichen: TÜV SÜD Production monitored Safety tested

Produkt: **Laborgeräte (Vakuumtrockenschränke)**

Modell(e): **APT. line Serie VDL 23, VDL 53, VDL 115**

Kenndaten:

Nennaufnahme:	0,8 kW, 1,2 kW, 1,9 kW
Nennspannung:	230V~, 50 Hz
Schutzklasse:	I
	IP 54
Trockenkammer:	Ex II 3 G max. 320°C

Besondere Bedingungen sind zu beachten.

Geprüft nach:
EN 61010-1:2001
EN 61010-2-010:2003
EN 1127-1:1997
EN 60079-14:1997
BGR 104:2000

Das Produkt wurde auf freiwilliger Basis auf die Einhaltung der grundlegenden Anforderungen geprüft und kann mit dem oben abgebildeten Prüfzeichen gekennzeichnet werden. Eine Veränderung der Darstellung des Prüfzeichens ist nicht erlaubt. Umseitige Hinweise sind zu beachten.

Prüfbericht Nr.: 71309583-1

Gültig bis: 2012-02-08

Datum, 2007-02-08

Seite 1 von 1

TÜV SÜD 245203

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

EC – Declaration of Conformity

EG – KONFORMITÄTSERKLÄRUNG
EC - DECLARATION OF CONFORMITY
CE - DECLARATION DE CONFORMITE

Anbieter / Supplier / Fournisseur:	BINDER GmbH
Anschrift / Address / Adresse:	Im Mittleren Ösch 5, D-78532 Tuttlingen
Produkt / Product / Produit:	Sicherheits-Vakuumtrockenschränke mit Programmregelung Safety vacuum drying ovens with program control Etuves de séchage à vide de sécurité à régulation programmable
Typenbezeichnung / Type / Type:	VDL 23, VDL 53, VDL 115

Die oben beschriebenen Produkte sind konform mit der folgenden EG-Richtlinie:
The products described above are in conformity with the following EC guideline:
Les produits décrits ci-dessus sont conformes à la directive CE suivante:

ATEX-Richtlinie 94/9/EG ATEX Directive 94/9/EC Directive ATEX 94/9/CE	Richtlinie 94/9/EG des Europäischen Parlaments und des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen. Directive 94/9/EC of the European parliament and the council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres Directive 94/9/CE du parlement européen et du conseil du 23 mars 1994 concernant le rapprochement des législations des États membres pour les appareils et les systèmes de protection destinés à être utilisés en atmosphères explosibles.

Die oben beschriebenen Produkte tragen entsprechend die Kennzeichnung CE.
The products described above, corresponding to this, bear the CE-mark.
Les produits décrits ci-dessus, en correspondance, portent l'indication CE.

Die Ex-Klassifikation des Geräteinnenraums nach ATEX Richtlinie 94/9//EG ist
The Ex classification of the inner chamber according to ATEX Directive 94/9/EC is
La classification Ex de la chambre intérieure selon la Directive 94/9/CE ATEX est

II 3 G

Die Temperaturklasse des Geräteinnenraums nach EN 60079-14 ist abhängig von der Einstellung des Temperaturwählbegrenzers und kann **T1**, **T2** oder **T3** sein. Die Temperaturklasse des Gesamtgerätes entspricht der Temperaturklasse des Innenraums.

The temperature class of the inner chamber acc. to EN 60079-14 depends on the setting of the temperature safety device and can be **T1**, **T2** or **T3**. The temperature class of the entire unit is equal to the temperature class of the inner chamber.

La classe de température de la chambre intérieure selon EN 60079-14 dépend du réglage de la sécurité de surchauffe. Elle peut être **T1**, **T2** ou **T3**. La classe de température de l'appareil entier est égale à celle de la chambre intérieure.

Die oben beschriebenen Produkte sind konform mit folgenden harmonisierten Normen:
The products described above are in conformity with the following harmonized standards:
Les produits décrits ci-dessus sont conformes aux normes harmonisées suivantes:

Sicherheit / safety / sécurité:

EN 61010-1:2010	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen (DIN EN 61010-1:2002 + Berichtigung 1:2002 + Berichtigung 2:2004)
	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements (IEC 61010-1:2010, BS EN 61010-1:2010)
	Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 1: Prescriptions générales (CEI 61010-1:2010, NF EN 61010:2011)
EN 61010-2-010:2003	Sicherheitsbestimmungen für elektrische Meß-, Steuer-, Regel- und Laborgeräte – Teil 2-010: Besondere Anforderungen an Laborgeräte für das Erhitzen von Stoffen (DIN EN 61010-2-010:2004)
	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-010: Particular requirements for laboratory equipment for the heating of materials (IEC 61010-2-10:2005, BS EN 61010-2-10:2003)
	Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 2-010 : Prescriptions particulières pour appareils de laboratoire utilisés pour l'échauffement des matières (CEI 61010-2-10:2003, NF EN 61010-2-10:2005)

EMV / EMC / CEM:

EN 61326-1:2006 + Corr. 1:2008 + Corr. 2:2010	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen (DIN EN 61326-1:2006 + Berichtigung 1:2008 + Berichtigung 2:2011)
	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2005 + Corr. 1:2008 + Corr. 2:2010, BS EN 61326-1:2006+ A1:2008)
	Matériel électrique de mesure, de commande et de laboratoire - Exigences relatives à la CEM - Partie 1: Exigences générales (CEI 61326-1:2005 + AC1:2008, NF EN 61326-1:2006 mod.)
EN 61326-2-2:2006	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen. Teil 2-2: Besondere Anforderungen - Prüfanordnung, Betriebsbedingungen und Leistungsmerkmale für ortsveränderliche Prüf-, Mess- und Überwachungsgeräte in Niederspannungs-Stromversorgungsnetzen. (DIN EN 61326-2-2:2006)
	Electrical equipment for measurement, control and laboratory use – EMC requirements. Part 2-2: Particular requirements - Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems. (IEC 61326-2-2:2005, BS EN 61326-2-2:2006)
	Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM. Partie 2-2: Exigences particulières - Configurations d'essai, conditions de fonctionnement et critères d'aptitude à la fonction des matériels portatifs d'essai, de mesure et de surveillance utilisés dans des systèmes de distribution basse tension. (CEI 61326-2-2:2005 + AC1:2007, NF EN 61326-2-2:2006)

Explosionsschutz / Explosion protection / Protection contre les explosions

EN 1127-1:2007	Explosionsfähige Atmosphären. Explosionsschutz. Teil 1: Grundlagen und Methodik (DIN EN 1127-1:2008)
	Explosive atmospheres. Explosion prevention and protection. Part 1: Basic concepts and methodology (BS EN 1127-1:2007)
	Atmosphères explosives. Prévention de l'explosion et protection contre l'explosion. Partie 1: Notions fondamentales et méthodologie (NF EN 1127-1:2008)
EN 60079-14:2008	Explosionsfähige Atmosphäre. Teil 14: Projektierung, Auswahl und Errichtung elektrischer Anlagen (DIN EN 60079-14:2009, VDE 0165-1:2009)
	Explosive atmospheres. Part 14: Electrical installations design, selection and erection (BS EN 60079-14:2008, IEC 60079-14:2007)
	Atmosphères explosives. Partie 14: conception, sélection et construction des installations électriques (NF EN 60079-14:2008, CEI 60079-14:2007)
EN 60079-15:2010	Explosionsfähige Atmosphäre. Teil 15: Geräteschutz durch Zündschutzart "n"
	Explosive atmospheres. Part 15: Equipment protection by type of protection "n" (IEC 60079-15:2010)
	Atmosphères explosives. Partie 15: Protection du matériel par mode de protection "n" (NF EN 60079-15:2010, CEI 60079-15:2010)

D-78532 Tuttlingen, 03.08.2011

BINDER GmbH

P. M. Binder

Geschäftsführender Gesellschafter
Managing Director
Directeur général

i. V. Dr. v. Both

Dr. H. von Both

Leiter F & E
Director R & D
Chef de service R&D

Product registration

Online Product Registration

Register your BINDER now!

www.binder-world.com/register

The registration is free and takes just a few seconds

Advantages:

- Short response times if service is needed
- Fair prices when relocating or installing equipment
- Calibration as required at no charge in case of recalls
- Free information on news, product upgrades and accessories

Easy registered in 3 steps:

Nominal temperature XXX °C XXX °F
Enclosure Protection XX XX
Temp. safety device XXX XXXXX
Class XXX
Art. No. XXXX-XXXX
Project No. XXXX
US PATS XXXXXX / XXXXX / XXXXX
XXXXXX / XXXXX / XXXXX / XXXXX
Made in Germany
Serial No. 12-34567
BINDER

1. List serial number here: ☐☐-☐☐☐☐☐
2. Go online: www.binder-world.com/register
3. Register serial number

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Dear customer,

For the correct operation of the program controlled safety vacuum drying oven VDL, it is important that you read this operating manual completely and carefully and observe all instructions as indicated. Failure to read, understand and follow the instructions may result in personal injury. It can also lead to damage to the unit and/or poor equipment performance.

1. Safety

This operating manual is part of the components of delivery. Always keep it handy for reference. The device should only be operated by laboratory personnel especially trained for this purpose and familiar with all precautionary measures required for working in a laboratory. To avoid injuries and damage observe the safety instructions of the operating manual.

WARNING

Failure to observe the safety instructions.

Serious injuries and unit damage.

- Observe the safety instructions in this operating manual.
- Carefully read the complete operating instructions of the VDL safety vacuum drying oven.

1.1 Legal considerations

This operating manual is for informational purposes only. It contains information for installing, start-up, operation and maintenance of the product. Note: the contents and the product described are subject to change without notice.

Understanding and observing the instructions in this operating manual are prerequisites for hazard-free use and safety during operation and maintenance. In no event shall BINDER be held liable for any damages, direct or incidental arising out of or related to the use of this manual.

This operating manual cannot cover all conceivable applications. If you would like additional information, or if special problems arise that are not sufficiently addressed in this manual, please ask your dealer or contact us directly by phone at the number located on page one of this manual

Furthermore, we emphasize that the contents of this operating manual are not part of an earlier or existing agreement, description, or legal relationship, nor do they modify such a relationship. All obligations on the part of BINDER derive from the respective purchase contract, which also contains the entire and exclusively valid statement of warranty administration. The statements in this manual neither augment nor restrict the contractual warranty provisions.

Have repairs performed only by experts authorized by BINDER. Repaired units must comply with the quality standard specified by BINDER.

1.2 Structure of the safety instructions

In this operating manual, the following safety definitions and symbols indicate dangerous situations following the harmonization of ISO 3864-2 and ANSI Z535.6.

1.2.1 Signal word panel

Depending on the probability of serious consequences, potential dangers are identified with a signal word, the corresponding safety color, and if appropriate, the safety alert symbol.

DANGER

Indicates an imminently hazardous situation that, if not avoided, will result in death or serious (irreversible) injury.

WARNING
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious (irreversible) injury.

CAUTION
Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor (reversible) injury.

CAUTION
Indicates a potentially hazardous situation, which, if not avoided, may result in damage to the product and/or its functions or to property in its proximity.

1.2.2 Safety alert symbol

Use of the safety alert symbol indicates a **risk of injury**.

Observe all measures that are marked with the safety alert symbol in order to avoid death or injury.

1.2.3 Pictograms

Warning signs			
Electrical hazard	Hot surface	Explosive atmosphere	Stability hazard
Inhalation hazard	Pollution Hazard	Harmful substances	Biohazard
Lifting hazard			
Mandatory action signs			
Mandatory regulation	Read operating instructions	Disconnect the power plug	Lift with several persons
Environment protection	Wear eye protectors		

Prohibition signs			
Do NOT touch	Do NOT spray with water		

	Information to be observed in order to ensure optimum function of the product.

1.2.4 Word message panel structure

Type / cause of hazard.

Possible consequences.

∅ Instruction how to avoid the hazard: prohibition

➢ Instruction how to avoid the hazard: mandatory action

Observe all other notes and information not necessarily emphasized in the same way, in order to avoid disruptions that could result in direct or indirect injury or property damage.

1.3 Localization / position of safety labels on the unit

The following labels are located on the unit:

Pictograms (Warning signs)	Service label
Hot surface	Service - Hotline International: + 49 (0) 7462 / 2005-555 USA Toll Free: + 1 866 885 9794 or: + 1 631 224 4340 Россия и СНГ: + 7 495 98815 17 service@binder-world.com www.binder-world.com BINDER

Figure 1: Position of labels on the unit

	Keep safety labels complete and legible.

Replace safety labels that are no longer legible. Contact BINDER Service for these replacements.

1.4 Type plate

Position of type plate: left unit side (seen from front), at the bottom right-hand.

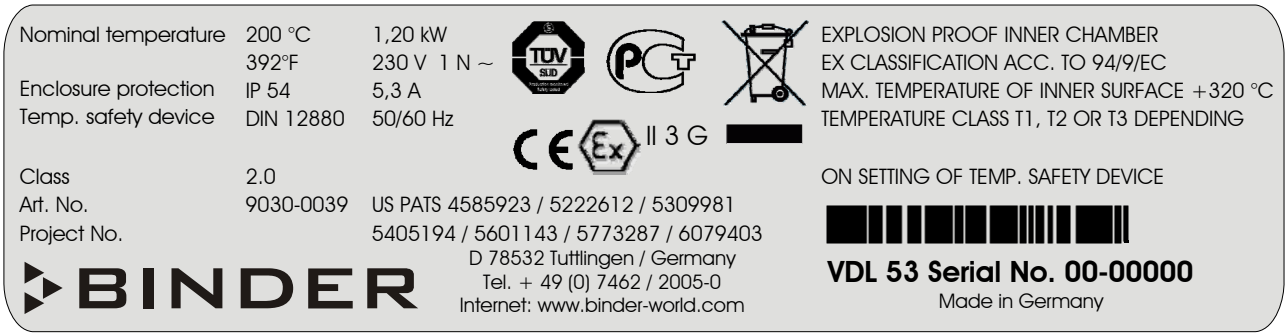

Nominal temperature 200 °C 1,20 kW
392°F 230 V 1 N ~
Enclosure protection IP 54 5,3 A
Temp. safety device DIN 12880 50/60 Hz
II 3 G
EXPLOSION PROOF INNER CHAMBER
EX CLASSIFICATION ACC. TO 94/9/EC
MAX. TEMPERATURE OF INNER SURFACE +320 °C
TEMPERATURE CLASS T1, T2 OR T3 DEPENDING
ON SETTING OF TEMP. SAFETY DEVICE
Class 2.0
Art. No. 9030-0039
Project No.
US PATS 4585923 / 5222612 / 5309981
5405194 / 5601143 / 5773287 / 6079403
BINDER
D 78532 Tuttlingen / Germany
Tel. + 49 (0) 7462 / 2005-0
Internet: www.binder-world.com
VDL 53 Serial No. 00-00000
Made in Germany

Figure 2: Type plate (example of VDL 53 regular unit)

Indications of the type plate		Information
BINDER		Manufacturer: BINDER GmbH
VDL 53		Model VDL 53
Serial No.	00-00000	Serial No. 00-00000
Nominal temperature	200 °C 392°F	Nominal temperature
Enclosure protection	IP 54	IP type of protection 54 acc. to EN 60529
Temp. safety device	DIN 12880	Temperature safety device acc. to standard DIN 12880
Class	2.0	Temperature safety device, class 2
Art. No.	9030-0039	Art. No. 9030-0039
Project No.	---	(Special application acc. to project no.)
1,20 kW		Nominal power 1.20 kW
230 V 1 N ~		Nominal voltage 230 V ± 10%, single-phase unit
5,3 A		Nominal current 5.3 Amp
50/60 Hz		Power frequency 50/60 Hz
Explosion proof inner chamber		Explosion proof inner chamber
Ex classification acc. to 94/9/EC		Ex classification according to ATEX Directive 94/9/EC
Max. temperature of inner surface 320 °C		Maximum temperature of the inner surfaces: 320 °C / *608°F*
Temperature class T1, T2 or T3 depending on setting of temp. safety device		Temperature class acc. to IEC 60079-14 for entire unit: T1, T2 or T3 depending on the setting of the temperature safety device

Symbol	Information
CE	CE conformity marking
II 3 G	Ex classification acc. to ATEX Directive 94/9/EC, referring to the inner chamber
	TÜV mark of conformity (Mark P)
	Electrical and electronic equipment manufactured / placed on the market in the EC after 13 August 2005 and to be disposed of in a separate collection according to directive 2002/96/EC on waste electrical and electronic equipment (WEEE).
	The equipment is certified in the GOST R certification system of GOSTSTANDARD Russia.

1.5 General safety instructions on installing and operating the safety vacuum drying oven

With regard to operating the safety vacuum drying oven VDL and to the installation location, please observe the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany).

BINDER GmbH is only responsible for the safety features of the unit provided skilled electricians or qualified personnel authorized by BINDER perform all maintenance and repair, and if components relating to chamber safety are replaced in the event of failure with original spare parts.

To operate the unit, use only original BINDER accessories or accessories from third-party suppliers authorized by BINDER. The user is responsible for any risk caused by using unauthorized accessories.

1.5.1 Safety instructions on installation and ambient conditions

Familiarize yourself with the local conditions, particularly allocation to a defined potentially explosive area (zones) and the relevant technical safety requirements. During installation, commissioning and operation of the vacuum drying oven and the connected vacuum pump or in-house vacuum supply, always follow the requirements defined by the installation site.

CAUTION

Danger of overheating.

Damage to the unit.

∅ Do NOT install the oven in unventilated recesses.

➢ Ensure sufficient ventilation for dispersal of the heat.

Do not operate the safety vacuum drying oven VDL in hazardous locations.

DANGER

Explosion hazard.

Danger of death.

∅ Do NOT operate the unit in potentially explosive areas.

➢ KEEP explosive dust or air-solvent mixtures AWAY from the unit.

The safety vacuum drying ovens were constructed in accordance with the applicable VDE regulations and were routinely tested in accordance with VDE 0411-1 (IEC 61010-1). The production underlies an internal monitoring according to ATEX Directive 94/9/EC appendix VIII.

Even when the equipment is used properly, there exists a residual risk of explosion that cannot be excluded, particularly in relation to the environment of the unit. To minimize this risk, strictly observe the legal regulations about how to select an appropriate location.

DANGER

Explosion hazard.

Danger of death.

➢ Strictly observe the legal regulations about how to select an appropriate location.

1.5.2 Safety instructions on vacuum supply

Pertaining to units that will be operated in potentially explosive areas, the requirements of ATEX Directive 94/9/EC have to be met as of July 1, 2003.

If combustible solvent is introduced into the drying chamber, the vacuum pump must be constructed in a suitable explosion-proof manner.

	Observe the safety instructions of the pump manufacturer.

The mixtures extracted from the inner chamber must be carried away making sure that there is no danger by ignition of these atmospheres. Otherwise, use flame arresters (flame flash-through barrier). For installing a flame arrester, please contact the BINDER INDIVIDUAL team.

In case of an explosion, the flame can be suctioned into an in-house vacuum system thereby resulting in further explosions.

	DANGER **Danger due to flame flash-through with in-house vacuum system.** **Danger of death.** ➢ We recommend installing a flame arrester (flame flash-through barrier) according to EN 12874 between the VDL vacuum drying oven and the in-house vacuum system.

Sparking in the pump motor or the switching elements, electrostatic discharges, as well as hot pump parts can ignite solvent vapors in the event of an error. To minimize this risk, use an ATEX (Directive 94/9/EC) compliant vacuum pump suitable for suction from Zone 0 or 1 and, if appropriate, from the zone of its installation site.

	DANGER **Ignition of emerging solvent vapors due to sparking in the pump motor or the switching elements, electrostatic discharges, hot pump parts.** **Explosion hazard.** **Danger of death.** ➢ Use only suitable, explosion-proof pumps ➢ Operate the pump in a stationary position and secure it so it is immobile. ➢ Install a fixed and conductive suction line to the vacuum connection (13). ➢ Install a fixed and conductive exhaust pipe in case it may conduct ignitable solvent concentrations. This should be avoided by sufficient solvent condensation e.g., in an exhaust waste vapor condenser ➢ When using ATEX (Directive 94/9/EC) non-compliant pumps: Provide a current-dependent, delayed protective device for the pump (for the triggering time of this protective device, see the manufacturer's specifications). The protective and monitoring device must not be able to turn on independently again or be released. ➢ When using ATEX (Directive 94/9/EC) non-compliant pumps: Install the switch gear box outside the hazardous area or provide it with explosion protection. ➢ Assure equipotential bonding between the pump housing and the housing of the VDL safety vacuum drying oven by the connected equipment grounding conductors of both units.

	The ATEX (Directive 94/9/EC) compliant pumps offered by BINDER provide an integral protective device.

	The ATEX (Directive 94/9/EC) compliant pumps offered by BINDER provide an integral explosion proof switch.

	Confirm that the vacuum source is designed for a gas inlet temperature corresponding to the used drying temperature, or take appropriate measures to cool down the extracted vapor before it enters the vacuum source.

The ATEX (Directive 94/9/EC) compliant vacuum pumps offered by BINDER are designed for a gas inlet temperature of 40 °C / *104°F* max. Do NOT exceed this temperature. If the gas inlet temperature is too high and then becomes even warmer by compression in the pump, the resulting temperature (of the gas-solvent mixture inside the pump) could exceed the solvent's temperature class and ignition temperature.

	DANGER
	Exceeding the gas inlet temperature. **Exceeding the ignition temperature of the solvent.** **Risk of ignition and explosion.** **Damage to the vacuum pump.** **Danger of death.** ∅ Do NOT exceed a set-point temperature of 40 °C / *104 °F*. ➢ With set-point temperature > 40 °C / *104 °F*, take appropriate measures to cool down the extracted vapor before it enters into to the vacuum pump.

1.5.3 Safety instructions on the charging material

The temperature class of the inner chamber according to IEC 60079-14 can be T1, T2, or T3. Only introduce substances with an ignition temperature that is higher than 135 °C / *275°F*. You can use a solvent which would form an explosive mixture with air under normal conditions.

This unit is not suitable to dry substances with an ignition temperature below 135 °C / *275°F*. Substances falling under ignition group IIC are not permitted (e.g. carbon disulfide, hydrogen).

	DANGER
	Inappropriate charging material. **Explosion hazard.** **Danger of death.** ∅ Do NOT introduce any substance with an ignition temperature below 135 °C / *275 °F* into the oven. ∅ Do NOT introduce hazardous dusts or fibrous materials, which tend towards exothermal decomposition into the oven. ∅ Do NOT introduce materials that come under the explosive substance law into the oven.

If the ignition temperature of a solvent contained in the drying material is exceeded during the drying process, there is an immediate risk of fire and explosion.

DANGER

Formation of explosive solvent-air mixtures.

Fire and explosion hazard.

Danger of death.

∅ The ignition temperature of the contained solvents must NEVER be reached. For safety reasons, you must provide a safety gap.

If the following precautions are not followed, the vapors resulting from heating of the solvent can ignite on the hot walls of the inner chamber.

Required measures:

- The maximum drying temperature is a result of the lowest ignition temperature of the introduced solvent or solvent mixture. Take the ignition temperature from the safety specifications of the solvent. Determine the maximum drying temperature according to the information panel “Temperature setting” (chap. 2.5) on the unit front. Do NOT exceed this temperature when presetting the set point on the RD3 temperature controller.
- Before starting the drying process, set the temperature safety device to the maximum allowed drying temperature according to the information panel “Temperature setting” (chap. 2.5). This will ensure that even in the event of error or an incorrect increase of the temperature set point on the RD3 controller the maximum permissible drying temperature is not exceeded. It is NOT sufficient to directly adjust the maximum temperature of the temperature safety device to the maximum temperature of the solvent’s temperature class.
- During the drying process, use only those solvents for which the temperature setting has been performed.
- In the case of solvent mixtures, use the ignition temperature of the material with the lowest ignition temperature. For the correct ignition temperature, refer to the safety specifications of the solvent.
- Let the oven cool down to ambient temperature before you start a new drying process with a modified ignition temperature.

Familiarize yourself with the physical and chemical properties of the charging material, as well as the contained moisture constituent and its behavior with the addition of heat energy and changes in pressure. No dangerous chemical reactions must occur during the drying process.

Familiarize yourself with any potential health risks caused by the charging material, the contained moisture constituent or by reaction products that may arise during the drying process. Take adequate measures to exclude such risks prior to putting the VDL safety vacuum drying oven into operation.

1.5.4 Safety instructions on operating the safety vacuum drying oven

DANGER

Electrical hazard.

Danger of death.

∅ The oven must NOT become wet during operation or maintenance.

CAUTION

The inner chamber will become hot during operation.

Danger of burning.

∅ Do NOT touch the inner surfaces or the charging material during operation.

During operation with inert gas, the unit is supplied with an oxygen displacing gas (e.g. N_2). Note: inert gas can be hazardous to health or even lethal, depending on its concentration in the respirable air. The gas emerging in the system must be diverted from the installation area by a suitable suction plant (see technical ventilation measures as described in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany). Correctly follow the maximally permitted workspace concentration of the inert gas used.

WARNING

Release of inert gas.

Danger of poisoning.

➢ Ensure technical ventilation measures.

➢ Correctly follow the maximally permitted workspace concentration of the inert gas used.

➢ When decommissioning the safety vacuum drying oven, shut off the inert gas valve (6).

If solvent-containing air penetrates the electrical area of the oven, explosions may result.

DANGER

Solvent-containing air penetrating the electrical area of the oven.

Explosion hazard.

∅ Do NOT take the air, which will be used to supply the unit with compressed air, from a potentially explosive atmosphere.

Avoid the solvent accumulation in the vacuum module (option) as this would cause the vacuum module to become an explosive area (Zone 0 or 1 or 2). The VDL safety vacuum drying oven located on top of the module is not explosion-proof constructed in regards to its surroundings.

DANGER

Operation with material containing solvent that may be able to form an explosive mixture with air.

Explosion hazard.

➢ Follow the measures required for operation with solvent-containing materials that can form an explosive mixture with air.

Measures required for operation with solvent-containing materials that can form an explosive mixture with air:

- Only trained personnel with key-authorization can work on the VDL vacuum drying oven
- Sweep the area for electrical equipment with compressed air or inert gas for at least 15 minutes. Sweeping must take place during the entire operating cycle; otherwise the safety vacuum drying oven will shut off at all poles.
- Only after at least 15 minutes of sweeping, use the key switch to put the unit in operation.
- Determine the maximum drying temperature in relation to the ignition temperature of the solvent according to the information panel “Temperature setting” (chap. 2.5). Do NOT exceed this temperature when presetting the set point on the RD3 temperature controller.
- In the case of solvent mixtures, use the ignition temperature of the solvent with the lowest ignition temperature. For the ignition temperature, refer to the safety specifications of the solvent.
- Before starting the drying process, set the temperature safety device to the maximum allowed drying temperature according to the information panel “Temperature setting” (chap. 2.5). It is NOT sufficient to directly adjust the maximum temperature of the temperature safety device to the maximum temperature of the solvent’s temperature class.
- Introduce the drying material and turn on the vacuum pump.
- Start the drying process. The heating unit is only released when a vacuum of 125 ± 25 mbar / *3.69 ±0.74 inHg*) or below is reached.
- The duration of the drying process can be determined by means of the analogue pressure display on the oven. When the pressure drops to pump pressure, the drying process is finished.
- Stop the drying process.
- Ventilate the safety vacuum drying oven using the aeration valve for ambient air (5) or inert gas (6).
- Remove the charging material. Turn the key switch to position 0 (OFF) and remove the key to prevent unauthorized operation of the oven.
- Sweep the area for electrical equipment at least 15 minutes with compressed air or inert gas.
- Let the oven cool down to ambient temperature before you start a new drying process with a modified ignition temperature.

1.6 Intended use

The VDL safety vacuum drying ovens are suitable for drying and heat treatment of solid or pulverized charging material, as well as bulk material, using the supply of heat under vacuum.

During this process, the contained solvent may be able to form an explosive mixture with air under normal conditions. Generation of an explosive atmosphere and its ignition are prevented in the VDL safety vacuum drying ovens by various safety measures. The drying temperature with standard safety factor must lie below the ignition temperature and below the sublimation point of the charging material.

The temperature class of the inner chamber according to IEC 60079-14 can be T1, T2, or T3. Insert only substances with an ignition temperature that is higher than 135 °C / *275°F*. The unit is not suitable to dry substances with an ignition temperature below 135 °C / *275°F*. Substances falling under ignition group IIC are not permitted (e.g. carbon disulfide, hydrogen).

The VDL safety vacuum drying ovens are NOT suitable for the heat treatment of hazardous dusts or fibrous materials, which tend towards exothermal decomposition, or for materials that come under the legal definition of explosives. Dangerous chemical reactions must not occur during the drying process.

Following the instructions in this operating manual and conducting regular maintenance work (chap. 16) are part of the intended use.

1.6.1 Operation log

For safety reasons, keep an operation log.
The following contents must be entered and recorded:

- Type of solvent
- Ignition temperature
- Set temperature
- Set safety device
- Date
- Signature

Use the following page as a specimen or compile it in a suitable form.

Operation log for the VDL safety vacuum drying oven

Serial number.....

Solvent	Ignition temperature	Set drying temperature	Max. temperature of safety device	Date	Signature

2. Description of the equipment

The VDL safety vacuum drying oven has been inspected by the TÜV Product Service GmbH in accordance with all safety-relevant guidelines and bears the TÜV-Mark P mark. Consequently, it is also expressly approved for drying materials with unlimited quantities of organic solvents.

The regular model is equipped with an explosion proof inner chamber. The Ex classification of inner chamber according to ATEX Directive 94/9/EC is **II 3 G**. The description of explosion protection on the type plate determines the classification.

Maximum temperature of the inner surfaces: 320 °C / *608°F*.

The temperature class of the inner chamber acc. to IEC 60079-14: depends on the setting of the temperature safety device and can be **T1**, **T2** or **T3**. The temperature class of the entire unit equals the temperature class of the inner chamber.

All functions of the multifunctional program control can be set simply and conveniently via the easy to understand function keypad of the RD3 temperature program controller. This controller is equipped with touch function keys and a digital display and permits exact temperature setting and programming temperature cycles. The VDL provides almost unlimited possibilities of adapting to individual customer requirements based upon extensive programming options and on the week program timer and real time clock of the controller.

The electro-polished inner chamber, the rack holder, all of the unit's vacuum connections and valves are made of specially corrosion resistant stainless steel V4A (material no. 1.4571 in Germany). The housing is RAL 7035 powder-coated. All corners and edges are also completely coated. When operating the chamber at temperatures above 150 °C / *302°F*, the impact of the oxygen in the air may cause discoloration of the metallic surfaces (yellowish-brown or blue) by natural oxidation processes. These colorations are harmless and will in no way impair the function or quality of the unit.

The safety vacuum drying ovens in the APT.line™ are jacket-heated. The APT.line™ preheating chamber technique ensures a completely homogeneous jacket temperature, ensuring uniform heat transfer into the inner chamber. The low-loss heat transfer to the material uses the patented aluminum vacuum expansion racks (or optionally available in stainless steel V4A, 1.4571). The elastic-mounted safety glass window reliably compensates any overpressure or explosions that may occur. The additional polycarbonate panel ensures proven and effective splinter protection in the event of an implosion.

All VDL units provide an inert gas connection, a compressed air connection for sweeping the area for electrical equipment, and a measuring connection serving to connect a vacuum controller or a measuring access port.

The VDL safety vacuum drying oven is equipped with a serial interface RS 422 for computer communication, e.g. via the communication software APT-COM™ 3 DataControlSystem (option, chap.15.7). For further options, see chap. 19.3.

All installable items, such as racks and rack holders, can be easily removed. The completely smooth inner chamber with its rounded corners and internally welded seams is easy to clean.

The minimum working temperature of the VDL safety vacuum drying oven is approx. 15 °C / *27 °F* above room temperature. The maximum temperature is 200 °C / *392°F*.

Vacuum pumps with a suction capacity of 1 m^3/h to 30 m^3/h are suitable for the VDL safety vacuum drying oven. The permissible end vacuum is 10^{-2} mbar / *0.0003 inHg*.

2.1 Safety equipment

- **Pressure control device**

  The VDL safety vacuum drying oven is equipped with a pressure control device with atmospheric pressure compensation and has a set switch point of 125 ± 25 mbar / *3.69 ± 0.74 inHg*). In the event of malfunction, some procedures would become an ignition source. Due to monitoring by the pressure control device such actions will only initiate if the pressure in the drying chamber is not higher than 125 ± 25 mbar / *3.69 ± 0.74 inHg.*

	The heating is released when a vacuum of 125 ± 25 mbar / *3.69 ± 0.74 inHg*) or below is obtained. It will activate only then.

- **Safety device class 2**

  This safety device protects the VDL safety vacuum drying oven, its environment and the charging material against impermissible excess temperatures. When correctly set to the maximum permissible drying temperature it prevents exceeding the maximum drying temperature in case of a fault (chap. 12).

- **Sweeping the area for electrical equipment and the preheating chamber with compressed air**

  The area for electrical equipment and the preheating chamber are protected against explosion by a technical ventilation system, which reliably prevents the penetration of explosive atmosphere to electrical or electronic parts of the VDL safety vacuum drying oven (protection against solvent-containing ambient air).

- **Flame protection gasket**

  In case of an explosion, the flame protection gasket prevents any flames from emerging directly through the door gap..

- **Spring-mounted safety glass panel and splinter protection**

  The VDL safety vacuum drying oven is equipped with a large-surface area safety valve.

  The inspection window, consisting of ESG glass (toughened safety glass), is spring-mounted and serves as a safety valve in the event of explosion. The additional plastic panel provides splinter-protection.

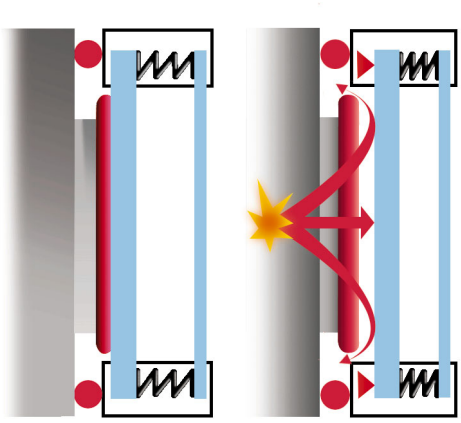


Figure 3: Safety glass panel

2.2 Overview of the oven

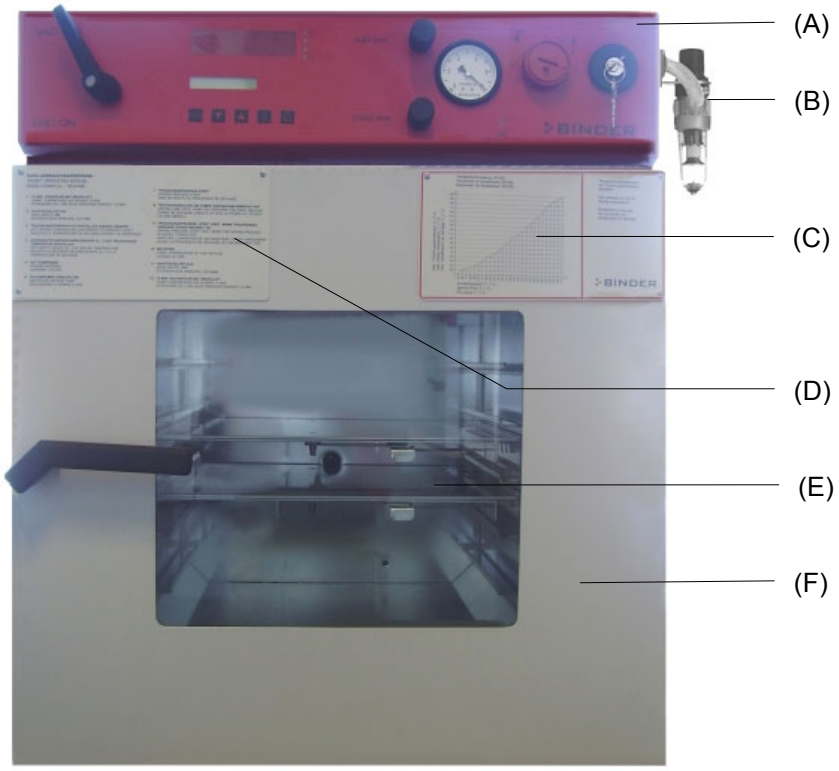


Figure 4: VDL 53

(A) Area for electrical equipment swept with compressed air, and control panel
(B) Compressed air connection
(C) Information panel “Temperature setting”
(D) Information panel short description
(E) Spring-mounted safety glass window
(F) Unit door

2.3 VDL control panel

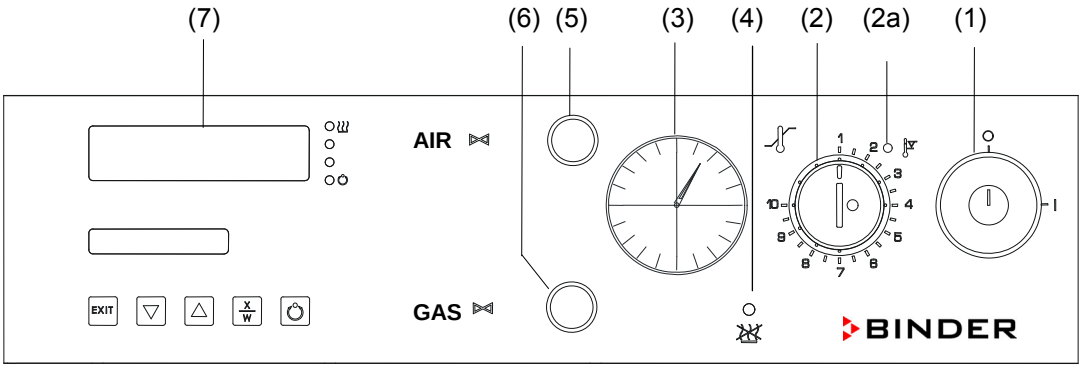


Figure 5: VDL 23 control panel

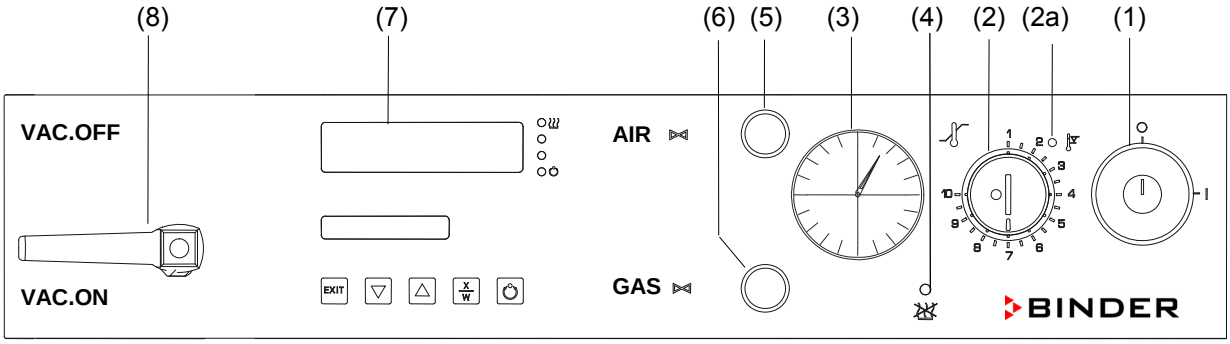
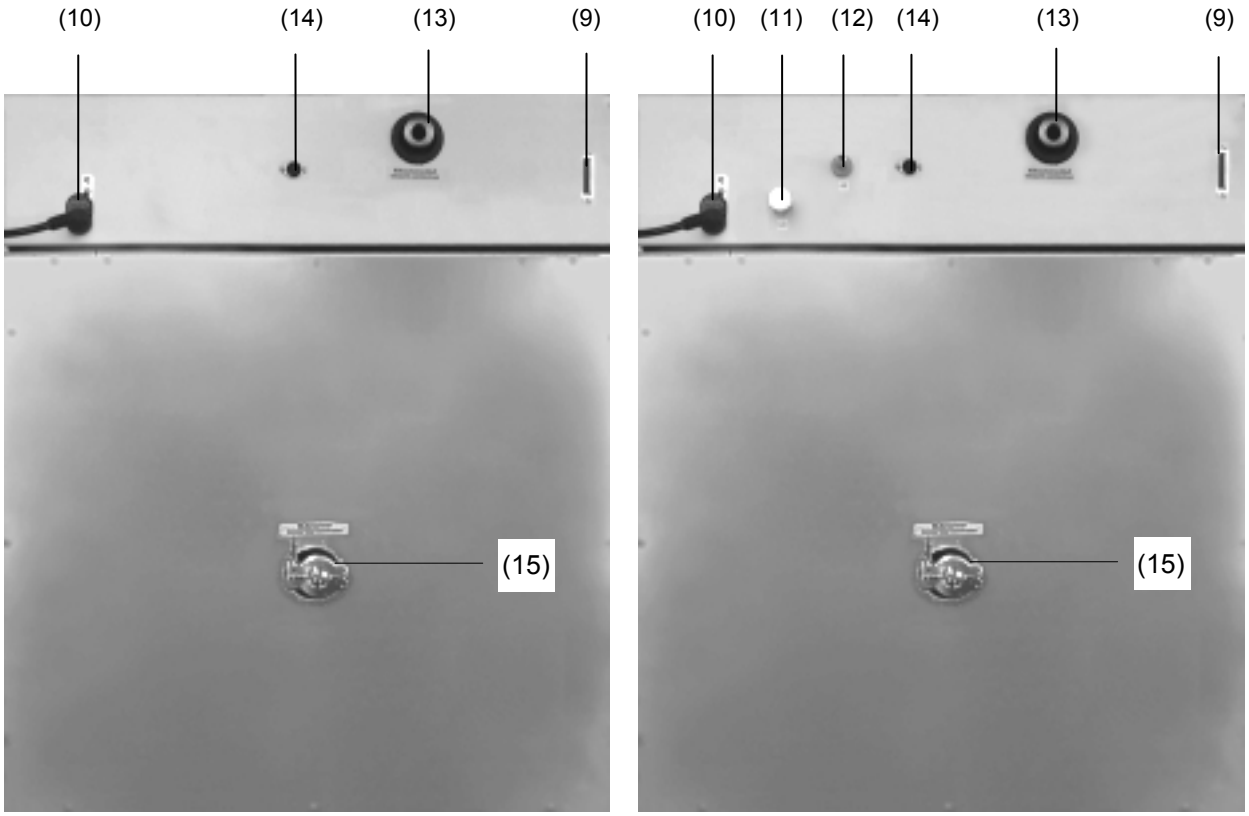


Figure 6: VDL 53/115 control panel

(1) Key switch (main power switch)
(2) Temperature safety device class 2
(2a) Red alarm lamp of the safety device class 2
(3) Manometer (pressure reading)
(4) Yellow pilot light: No heating release
(5) Aeration valve (ambient air)
(6) Fine dosing valve (inert gas)
(7) Program controller RD3
(8) Vacuum shut-off valve

2.4 Connections at the rear of the unit



VDL 23 VDL 53 / VDL 115

Figure 7: Rear of VDL

(8) Vacuum shut-off valve

(9) RS 422 serial interface for computer communication

(10) Power connection line

(11) Inert gas connection, adapter with hose olive ∅ 8 mm / *0.31 in*

(12) Fresh air connection (tube 8x1 mm)

(13) Vacuum connection with small flange DN16

(14) DIN socket “Object-Pt100“ (option) to connect a Pt 100 sensor (with option “object temperature display”)

(15) Measuring connection with small flange DN16

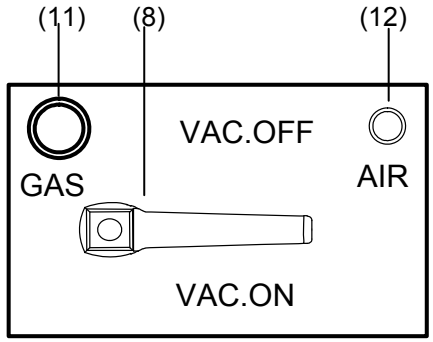


Figure 8: Connections left side VDL 23

2.5 “Temperature setting” information panel (ignition temperature vs. drying temperature)

This information panel is mounted to the door of the VDL safety vacuum drying oven and shows the maximum permissible drying temperature depending on the ignition temperature of the solvent.

The reading graph reflects the fact that the inner chamber walls will become warmer than the expansion racks, especially during the heating-up phase, and will thereby exceed the set-point temperature.

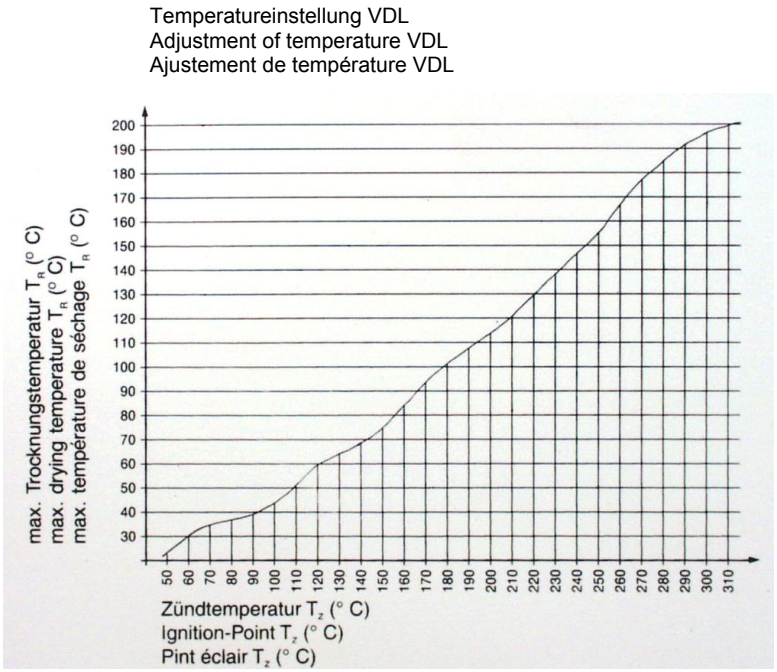


Figure 9: Temperature setting information panel

	You must observe the indicated safety margin between ignition temperature and drying temperature.

According to IEC 60079-14, you must introduce only substances with an ignition temperature which is higher than 135 °C / *275°F*. **This unit is NOT suitable to dry substances with an ignition temperature below 135 °C / *275°F*.**

If the ignition temperature of a solvent contained in the drying material is exceeded during the drying process, there is an immediate risk of fire and explosion.

	DANGER
	Exceeding the ignition temperature of a solvent. **Risk of fire and explosion.** **Danger of death.** ∅ The ignition temperature of a contained solvent must NEVER be reached. For safety reasons, always ensure that there is a safety margin.

	Required measures: • Determine the maximum drying temperature in relation to the ignition temperature of the solvent in accordance with the “Temperature setting” information panel (chap. 2.5). Do NOT exceed this temperature when presetting the set-point temperature at the temperature controller RD3. • Before starting the drying process, set the temperature safety device to the allowed maximum drying temperature according to the information panel “temperature setting” chap. 2.5), so that even in the event of error or incorrect increase of the temperature set-point on the RD3 controller the maximum permissible drying temperature is not exceeded. It is NOT sufficient to directly adjust the maximum temperature of the temperature safety device to the maximum temperature of the solvent’s temperature class. • (continued)

Required measures (continuation):

- During the drying process, use only those solvents for which the temperature setting has been performed.
- In the case of solvent mixtures, use the ignition temperature of the material with the lowest ignition temperature. For the ignition temperature, refer to the safety specifications of the solvent.
- Let the oven cool down to ambient temperature before you start a new drying process with a modified ignition temperature.

3. Completeness of delivery, transportation, storage, and installation

3.1 Unpacking, and checking equipment and completeness of delivery

After unpacking, please check the unit and its optional accessories, if any, based on the delivery note for completeness and for transportation damage. Inform the carrier immediately if transportation damage has occurred.

The final tests of the manufacturer may have caused traces of the racks on the inner surfaces. This has no impact on the function and performance of the unit.

Please remove any transportation protection devices and adhesives in/on the unit and on the doors and take out the operating manuals and accessory equipment.

CAUTION

Sliding or tilting of the unit.

Damage to the unit.

Risk of injury by lifting heavy loads.

∅ Do NOT lift or transport the unit using the door, the handle, or the lower housing.

➢ Lift units size 23 and 53 from the pallet at the four lower corners with the aid of 4 people.

➢ Lift units size 115 from the pallet with the aid of 6 people.

If you need to return the unit, please use the original packing and observe the guidelines for safe lifting and transportation (chap. 3.2).

For disposal of the transport packing, see chap. 17.1.

If you ordered the option “vacuum module with chemical membrane pump”, the pump will be delivered in a separate box and must be fitted into the module and connected at the place of installation (see chap. 15.3).

Note on second-hand units (Ex-Demo-Units):

Second-hand units are units that have been used for a short time for tests or exhibitions. They are thoroughly tested before resale. BINDER ensures that the chamber is technically sound and will work flawlessly.

Second-hand units are marked with a sticker on the unit door. Please remove the sticker before commissioning the unit.

3.2 Guidelines for safe lifting and transportation

After operation, please observe the guidelines for temporarily decommissioning the unit (chap. 17.2).

CAUTION

Sliding or tilting of the unit.

Damage to the unit.

Risk of injury by lifting heavy loads.

- ➢ Transport the unit in its original packaging only.
- ➢ For moving or shipping, secure the oven with transport straps.
- ∅ Do NOT lift or transport the unit using the door, the handle, or the lower housing.
- ➢ Lift units size 23 and 53 at the four lower corners with the aid of 4 people.
- ➢ Lift units size 115 with the aid of 6 people.

- Permissible ambient temperature range during transport: -10 °C / *14°F* to +60 °C / *140°F*.

You can order transport packing for moving or shipping purposes from BINDER Service.

3.3 Storage

Intermediate storage of the unit is possible in a closed and dry room. Observe the guidelines for temporary decommissioning (chap. 17.2).

- Permissible ambient temperature range during storage: -10 °C / *14°F* to +60 °C / *140°F*.
- Permissible ambient humidity: max. 70 % r.H., non-condensing

When after storage in a cold location you transfer the unit to its warmer installation site, condensation may form. Before start-up, wait at least one hour until the chamber has attained ambient temperature and is completely dry.

3.4 Location of installation and ambient conditions

Set up the VDL safety vacuum drying oven on a flat, even and non-flammable surface, free from vibration, in a well-ventilated, dry location and align it using a spirit level. The site of installation must be capable of supporting the unit's weight (see technical data, chap. 19.2). The chambers are designed for setting up inside a building (indoor use).

CAUTION

Danger of overheating.

Damage to the unit.

- ∅ Do NOT set up units in non-ventilated recesses.
- ➢ Ensure sufficient ventilation for dispersal of the heat.

- Permissible ambient temperature range during operation: +18 °C / *64°F* to +32 °C / *90°F*.

The ambient temperature should not be substantially higher than the indicated ambient temperature of +25 °C / *77°F* to which the specified technical data relate. Deviations from the indicated data are possible for other ambient conditions.

- Permissible ambient humidity: 70 % r.H. max., non-condensing.
- Installation height: max. 2000 m / *6562 ft* above sea level.

When placing several units of the same size side by side, maintain a minimum distance of 250 mm / *9.8 in* between each unit. Wall distances: rear 100 mm / *3.9 in*, sides 135 mm / *5.3 in*. Spacing above and behind the unit of at least 100 mm / *3.9 in* must also be maintained.

CAUTION

Danger by stacking.

Damage to the units.

∅ Do NOT place safety vacuum drying ovens on top of each other.

To completely separate the unit from the power supply, you must disconnect the power plug. Install the unit in a way that the power plug is easily accessible and can be easily pulled in case of danger.

Do not install or operate the safety vacuum drying oven VDL in potentially explosive areas.

DANGER

Explosion hazard.

Danger of death.

∅ Do NOT operate the unit in potentially explosive areas.

➢ KEEP explosive dust or air-solvent mixtures AWAY from the vicinity of the unit.

If no pumps are used for pumping from zone 0 or zone 1, we recommend an explosion-preventing decoupling (explosion barrier, flame arrester, flame flash-through barrier acc. to EN 12874) between the inner chamber and the vacuum pump. For installing a flame arrester, please contact the BINDER INDIVIDUAL team.

Follow country-specific regulations for explosion protection.

Before commissioning the unit, connect the vacuum drying oven to the compressed air supply.

Without the necessary compressed air connection, the unit will not have a current to operate.

For operation with inert gas, the unit is supplied with an oxygen-displacing gas (e.g. N_2). Note: inert gas can be hazardous to health or even lethal, depending on its concentration in the respirable air. The gas emerging from the system must be removed from the installation area by means of a suitable extraction system (see technical ventilation measures in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany). Correctly follow the maximally permitted workspace concentration of the inert gas used.

WARNING

Release of inert gas.

Danger of poisoning.

➢ Ensure technical ventilation measures.

➢ Correctly follow the maximally permitted workspace concentration of the inert gas used.

➢ When decommissioning the safety vacuum drying oven, shut off the inert gas valve (6).

If you ordered the option "vacuum module with chemical membrane pump", the pump will be delivered in a separate box and must be fitted into the module and connected at the place of installation (chap. 15.3).

	During operation a fire extinguisher must be available.

The maximum permissible ambient temperature of the vacuum pumps delivered by BINDER is 40 °C / *104°F*.

4. Installation and connections

4.1 Vacuum expansion racks

The low-loss heat transfer to the material occurs via the patented aluminum vacuum expansion racks (also available in stainless steel as an option). The strong tension causes the racks to fit tightly against the interior wall and their large-surface contact area ensures rapid and effective heat transfer.

The removable rack holders allow for easy positioning.

You can also remove the expansion racks for easy cleaning. Do not remove them too often in order to prevent wear.

Figure 10: Using the expansion racks

- Pushing the locking lever: The expansion rack is released and can be removed.
- Pulling the locking lever: The expansion rack is pressed against the inner chamber walls.

	Following each new tightening of an expansion rack, check that the lateral parts of the rack fit closely over their whole surface to the inner chamber wall. This is necessary in order to ensure the specified temperature exactitude.

	CAUTION
	Invalid calibration. ∅ Do NOT change between aluminum and stainless steel racks ➢ Use the delivered expansion racks only

4.2 Electrical connection

- The VDL safety vacuum drying oven comes with a fixed power connection cable that has a length of 1800 mm / *5.9 ft.* and a shockproof plug.
- Unit fuse 10 Amp
- Power supply voltage 230 V (1N~) ± 10 %, 50/60 Hz
- Prior to connection and start-up, check the power supply voltage. Compare the values to the specified data located on the unit's type plate (left side of the unit, bottom right-hand, chap. 1.4).
- When connecting, please observe the regulations specified by the local electricity supply company as well as the VDE directives (for Germany)
- Pollution degree (acc. to IEC 61010-1): 2
- Over-voltage category (acc. to IEC 61010-1): II

CAUTION

Danger of incorrect power supply voltage.

Damage to the equipment.

- ➢ Check the power supply voltage before connection and start-up.
- ➢ Compare the power supply voltage with the data indicated on the type plate.

See also electrical data (chap. 19.2).

To completely separate the unit from the power supply, you must disconnect the power plug. Install the unit in a way that the power plug is easily accessible and can be easily pulled in case of danger.

4.3 Vacuum connection

Always connect the VDL safety vacuum drying oven to a vacuum pump or to a domestic vacuum system. For this purpose, the vacuum connection (13) with small flange DN16 must be connected to the back of the unit at the top with the vacuum pump or domestic vacuum system via a vacuum suction hose. For connecting to the unit, BINDER recommends the connection kits VP4 (Art. no. 8012-0621) or VP5 (Art. no. 8012-0622), (chap. 15.1).

With the option “stainless steel tubing” between the vacuum oven and vacuum module, the vacuum connection is already located inside the vacuum module.

Vacuum pumps with a suction capacity of 1-30 m³/h are suitable for the VDL safety vacuum drying oven. Permissible end vacuum: 10^{-2} mbar / *0.0003 inHg*.

For use of vacuum pumps in the European Union, note the following points:

- Pertaining to units that will be operated in potentially explosive areas, the requirements of ATEX Directive 94/9/EC have to be met as of July 1, 2003.
- If combustible solvent will be introduced into the inner chamber, the vacuum pump must be constructed in a suitable explosion-proof manner. The mixtures extracted from the drying chamber must be carried away making sure that there is no danger by ignition of these atmospheres. Otherwise use flame arresters.

Follow the safety instructions of the pump manufacturer.

In case of an explosion, the flame may be suctioned into the in-house vacuum system and result in further explosions.

DANGER

Danger due to flame flash-through with in-house vacuum system.

Danger of death.

- ➢ We recommend installing a flame arrester (flame flash-through barrier) according to EN 12874 between the vacuum drying oven and the in-house vacuum system.

For installing a flame arrester, please contact the BINDER INDIVIDUAL team.

In the event of an error, sparking in the pump motor or the switching elements, electrostatic discharges, as well as hot pump parts can ignite solvent vapors. Minimize this risk by using an ATEX (Directive 94/9/EC) compliant vacuum pump suitable for suction from Zone 0 or 1 and, if appropriate, from the zone of its installation site.

DANGER

Ignition of emerging solvent vapors due to sparking in the pump motor or the switching elements, electrostatic discharges, hot pump parts.

Explosion hazard.

Danger of death.

- Use only suitable, explosion-proof pumps
- Operate the pump in a stationary position and secure it so it is immobile.
- Install a fixed and conductive suction line to the vacuum connection (13).
- Install a fixed and conductive exhaust pipe in case it may conduct ignitable solvent concentrations. This should be avoided by sufficient solvent condensation e.g., in an exhaust waste vapor condenser
- When using ATEX (Directive 94/9/EC) non-compliant pumps: Provide a current-dependent, delayed protective device for the pump (for the triggering time of this protective device, see the manufacturer's specifications). The protective and monitoring device must not be able to independently turn on again or be released.
- When using ATEX (Directive 94/9/EC) non-compliant pumps: Install the switch gear box outside the hazardous area or provide it with explosion protection.
- Assure that there is equipotential bonding between the pump housing and the housing of the VDL safety vacuum drying oven via the connected equipment grounding conductors of both units.

The ATEX (Directive 94/9/EC) compliant pumps offered by BINDER provide an integral protective device.

The ATEX (Directive 94/9/EC) compliant pumps offered by BINDER provide an integral explosion proof switch.

Make sure that the vacuum source is designed for a gas inlet temperature corresponding to the used drying temperature, or take appropriate measures to cool down the extracted vapor before it enters into the vacuum source.

The ATEX (Directive 94/9/EC) compliant vacuum pumps offered by BINDER are designed for a gas inlet temperature of 40 °C / *104°F* max. Do NOT exceed this temperature. If the gas inlet temperature is too high and then becomes even warmer by compression in the pump, the resulting temperature (of the gas-solvent mixture inside the pump) could exceed the solvent's temperature class and ignition temperature.

DANGER

Exceeding the gas inlet temperature.

Exceeding the ignition temperature of the solvent.

Risk of ignition and explosion.

Damage to the vacuum pump.

Danger of death.

∅ Do NOT exceed a set-point temperature of 40 °C / *104°F*.

- With set-point temperature > 40 °C / *104°F* take appropriate measures to cool down the extracted vapor before it enters into the vacuum pump.

4.3.1 Notes regarding use of vacuum pumps of other manufacturers

Connection to a vacuum source

Connect the vacuum connection (13) (small flange DN 16) at the back of the unit at the top to a vacuum pump or domestic vacuum system via a vacuum conduit or fixed vacuum tubing.

	Units that will be operated in potentially explosive areas, have to meet the requirements of ATEX Directive 94/9/EC since July 1, 2003. Follow the safety instructions in chap. 1.5.

	CAUTION
	Excessive low pressure. **Risk of technical defects.** ∅ The end vacuum must NOT fall below the permissible level of 10^{-2} mbar / *0.0003 inHg*. ➢ Install a pump according to the permissible end vacuum or limit it via a vacuum controller.

Extracted vapors can have a health damaging and/or corrosive effect on the unit and pump.

	CAUTION
	Release of extracted vapors. **Damage to health.** **Corrosion of oven and pump.** ➢ Conduct the extracted vapors e.g., into a fume extractor facility. Connect a suitable hose to the vacuum pump outlet (that may be located in the vacuum module).

4.4 Inert gas connection

When operating the VDL safety vacuum drying oven with inert gas, correctly follow the technical ventilation measures, as described in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany).

During operation with inert gas, the unit is supplied with an oxygen displacing gas (e.g. N_2). Note: inert gas can be hazardous to health or even lethal, depending on its concentration in the respirable air. Gas emerging in the system must therefore be diverted from the installation area by a suitable suction plant (see technical ventilation measures as described in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany).

	WARNING
	Release of inert gas. **Danger of poisoning.** ➢ Ensure technical ventilation measures. ➢ Correctly follow the maximally permitted workspace concentration of the inert gas used. ➢ When decommissioning the safety vacuum drying oven, shut off the inert gas valve (6).

Connect the inert gas supply to the inert gas connection (adapter with hose olive diameter 8 mm / *0.31 in*) via a pressure reducer. Screw the enclosed adapter with hose olive on the thread (11) at the unit rear. Set the pressure reducer to a pressure slightly above ambient pressure. Make sure that the pressure reducer will open.

Do not alter this setting in order to avoid perturbation inside the oven and the release of large quantities of inert gas after flooding the VDL.

	CAUTION
	Overpressure in the inner chamber. **Turbulence of the charging material.** ∅ Do NOT modify the atmospheric pressure setting.

4.5 Compressed air / inert gas connection for sweeping the area for electrical equipment

The compressed air flows through the area for electrical equipment as well the preheating chamber, which prevents a possible concentration of a solvent-containing atmosphere in the area for electrical equipment. You can alternatively connect inert gas or nitrogen to the compressed air connection. Use only dry gas.

In order to avoid that any oil coming from the compressed-air piping enters the vacuum drying oven, the compressor of the compressed air system must be equipped with an oil separator, or the compressed air system must be constructed oil-free. The condensate separator of the compressed air connection separates water and soil from the compressed-air piping, thus leading to compressed air quality class 4 acc. to ISO 8573-1. However, it does not prevent oil penetrating from the compressed air system, e.g. the compressed air compressor, into the compressed-air piping. The condensate separator is equipped with a manual condensate outlet (chap. 16.1).

Connection: Before commissioning, the existing compressed air unit must be connected on the right side of the unit (hose olive ∅ 8 mm) to a compressed air line (compressed air system) or to an inert gas supply. There must be an overpressure of at least 1.5 bar / *44.3 inHg* in the supply network. The maximally permitted pressure is 7 bar / *206.7 inHg*.

Immediately after connecting the compressed air or inert gas supply, the area for electrical equipment of the oven will be swept at 5 liters per minute. This air or inert gas quantity is used and then released into the surrounding atmosphere permanently; independent of the oven's operating state. Therefore the compressed air or inert gas connection on the building side should be equipped with a stop valve that can be used to cut off the gas supply, after having operated the drying oven.

Figure 11: Compressed air connection with condensate separator

During sweeping the area for electrical equipment with inert gas, the unit is supplied with an oxygen displacing gas (e.g. N_2). Note: inert gas can be hazardous to health or even lethal, depending on its concentration in the respirable air. The gas emerging in the system must be diverted from the installation area by a suitable suction plant (see technical ventilation measures as described in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany). Correctly follow the maximally permitted workspace concentration of the inert gas used.

	WARNING
	Release of inert gas. **Danger of poisoning.** ➢ Ensure technical ventilation measures. ➢ Correctly follow the maximally permitted workspace concentration of the inert gas used. ➢ When decommissioning the safety vacuum drying oven, shut off the inert gas valve (6).

If solvent-containing air penetrates the electrical area of the unit, explosions may result.

DANGER

Solvent-containing air penetrating the electrical area of the unit.

Explosion hazard.

∅ Do NOT take the air for the compressed air supply from explosive atmospheres.

If the unit is not connected to the compressed air supply, or if the specified overpressure is not reached, it is impossible to start the VDL vacuum drying oven.

The compressed air connection is preset at the factory. Do NOT change the setting. In delivery condition of the oven, this setting is protected by a cover with seal.

If the seal is broken, please inform BINDER Service to have the setting checked and to reinstall the cover with seal.

5. Start up

DANGER

Solvent-containing air penetrating and concentration in the electrical area of the unit.

Explosion hazard.

➢ Before turning on the unit via the key switch (1), sweep the area for electrical equipment at least 15 minutes with compressed air or inert gas. Sweeping the area for electrical equipment must take place during the entire operation, as otherwise the VDL safety vacuum drying oven will shut off at all poles.

After connecting the supply lines (chap 4) and checking all safety instructions and conditions of installation and safe operation, turn on the unit via the key switch (1):

- **Position 0:** Oven is not operating

  No consumption of compressed air or inert gas in the area for electrical equipment. If the fine dosage valve (6) is open, inert gas may be used and can reach the ambient air.

- **Position I**: Oven is operating

If no indication appears in the display of the program controller RD3, the compressed air supply is probably not properly connected.

5.1 Settings at the RD3 program controller

After turning the unit on with the key switch (1) the controller is in Normal Display / Fixed value operation mode.

Depending on the temperature value entered before, LED (7a) is lit if the heating is active, or no LED is lit if the actual temperature is equal to or above the set-point.

In **Display 1** of the controller the actual temperature value is displayed.

- With inactive week program timer:

  In **Display 2** of the controller the actual date and time are displayed. Example:

15.05.06 13:52

- With active week program timer:

  In **Display 2** of the controller the actual date and time and the states of the week program timer channels are displayed. Examples:

15.05.06 13:52 - -		15.05.06 13:52 - □		15.05.06 13:52 □ -		15.05.06 13:52 □ □
Channel 1 Off, Channel 2: Off		Channel 1: Off, Channel 2: On		Channel 1: On, Channel 2: Off		Channel 1 On, Channel 2: On

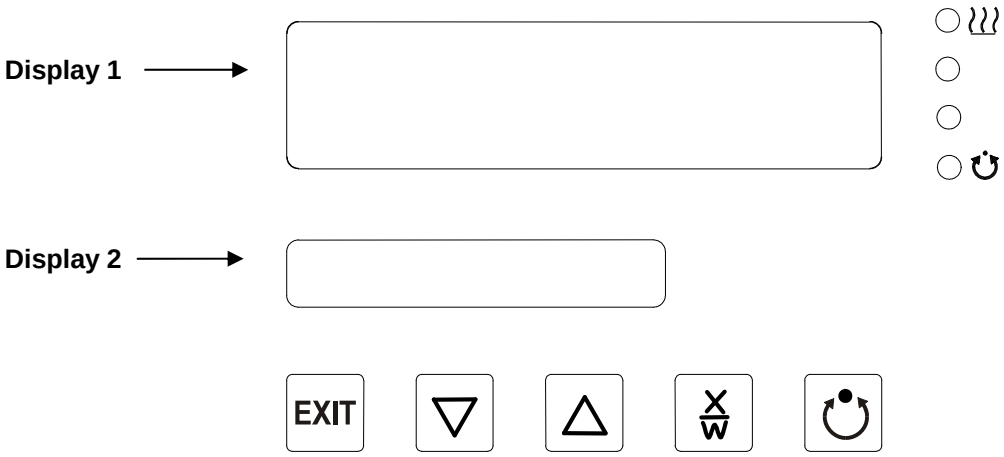


Figure 12: RD3 program controller

LED function indications and their signification:

(7a) (yellow) ○ ≀≀≀ Heating active

(7b) (yellow) ○ no function

(7c) (yellow) ○ no function

(7d) (green) ○ ↻ Illuminates: program operation

Flashes: exceeding of the tolerance limits in “Fixed value entry mode” or in “Program operation”. In “Program operation”: program interruption.

The program controller RD3 permits programming temperature cycles.

You can enter two programs with up to 10 sections each or one program with up to 20 sections (setting in the user level, chap. 10).

	When changing from 2 programs to 1 program or vice-versa, existing programs are deleted.

The maximum length of an individual program section can be set to either 99 h 59 min or to 999 h 59 min (setting in the user level, chap. 10). This setting is then valid for all program sections.

Programming can be done directly through the keypad of the controller or graphically through the software APT-COM™ 3 DataControlSystem (option, chap. 15.7) specially developed by BINDER.

5.2 General indications

The program controller RD3 offers several functional levels:

Normal Display / Fixed value operation:

- Display of the temperature actual value (display 1) and of the actual date and time (display 2).
- The oven is in fixed value operating mode, equilibrating to the entered set-points.

Fixed value entry mode (chap. 6)

- Entry of the temperature set-point for fixed value operating mode
- Entry of temperature set-points 1 and 2 for week program operation

Program editor (chap. 8)

- You can enter two programs with up to 10 sections each or one program with up to 20 sections (selection in the user level, chap. 10). Entry of temperature set-points in all program sections (chap. 8.1).
- Deleting a program section (chap. 8.4)

Program start level (chap. 9)

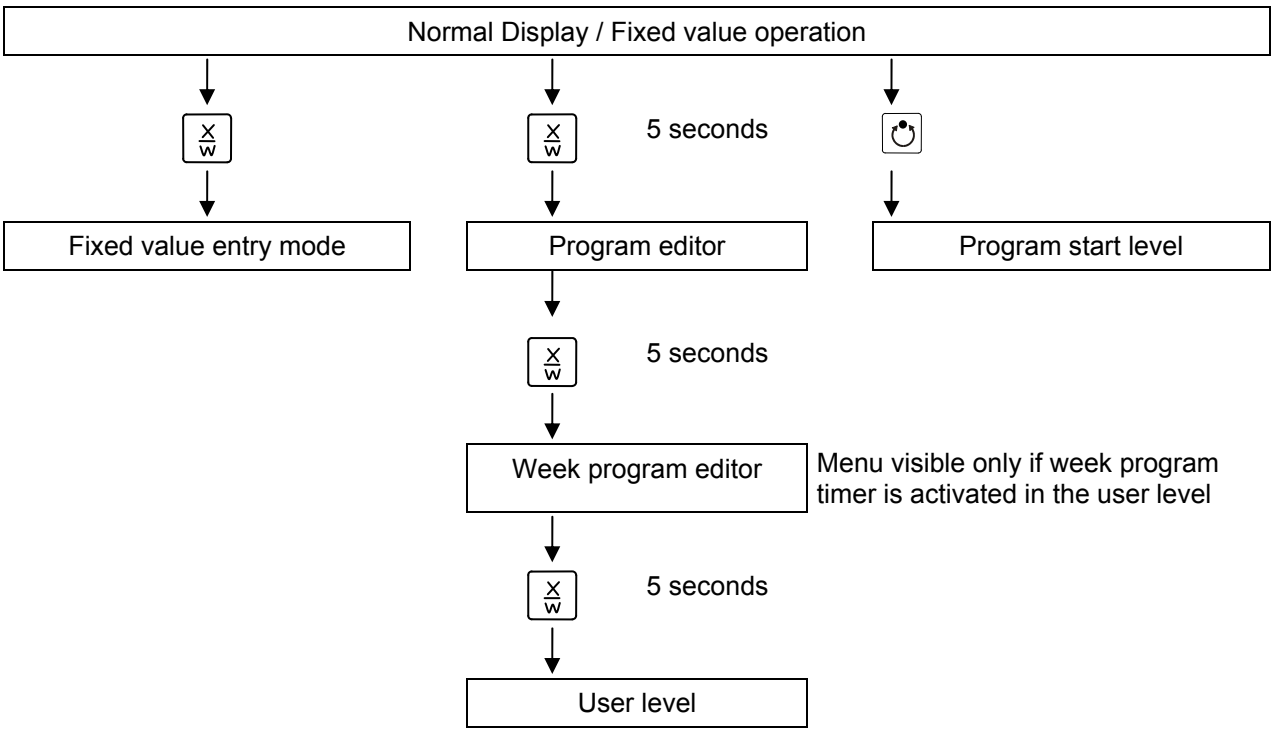
- Selection of an entered program
- Entry of settings affecting the program course, as “start delay time” or “number of program cycles”
- Program start

Week program editor (chap.7)

- Setting the shift points

User level (chap. 10)

- User specific controller settings
- Setting the real time clock



If no button is touched within more than 120 sec., the controller returns from the current level to Normal Display.

To avoid condensation inside the chamber and in the suction system, select an appropriate vacuum source to ensure its sufficient performance in relation to the released amount of steam. Coordinate drying temperature, suction performance of the vacuum source and the amount of charging material.

6. Fixed value entry mode

Solvents and resulting vapors can ignite at excessive drying temperatures.

DANGER

Excess drying temperature.

Ignition and explosion hazard.

- Determine the maximum drying temperature in relation to the ignition temperature of the solvent according to the information panel “Temperature setting” (chap. 2.5). Do NOT exceed this temperature when presetting the set point on the RD3 temperature controller.
- In case of solvent mixtures, use the ignition temperature of the material with the lowest ignition temperature.
- Before starting the drying process, set the temperature safety device (chap. 12) to the maximum permitted drying temperature according to the information panel “Temperature setting” (chap. 2.5).
- Start the drying process. The heating is only released when a vacuum of 125 ± 25 mbar / *3.69 ± 0.74 inHg*) or below is reached.

If you do not want to use the week program timer, deactivate it (factory setting, setting in the user level, chap. 10) before entering any set-points.

Basic entry principle: Access the individual parameters with button X/W. Enter the value with the arrow keys. A value flashing once after 2 seconds indicates that it has been applied by the controller.

→ **Normal Display**

Display 1 shows	e.g. 39.8 °C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time) (actual switching state of week program timer channel 1: Off, channel 2: Off, visible only if week program timer is activated in the user level, chap. 10)

Press key X/W ↓

Display 1 shows	e.g. 40.0 °C	(actual temperature set-point 1)
Display 2 shows	SP1 TEMPERATURE	(variable: temperature in °C)

Enter temperature set-point in °C using arrow keys ▼ ▲ ↓ Value is shown in display 1.

Press key X/W ↓

Display 1 shows	e.g. 50.0 °C	(actual temperature set-point 2) (visible only if week program timer is activated in the user level, chap. 10)
Display 2 shows	SP2 TEMPERATURE	(variable: temperature in °C)

Enter temperature set-point in °C using arrow keys ▼ ▲ ↓ Value is shown in display 1.

Press key X/W ↓

If no button is pressed within more than 120 sec, or if the "**EXIT**" button is pressed, the controller changes to Normal Display.

☞	When changing the set-point, check the setting of the safety device (chap. 12).

☞	The values entered in fixed-value entry mode remain valid after program run-off and are then equilibrated.

If the week program timer is active, depending on the running week program another set-point (SP2) may be targeted. Resulting high temperatures may exceed the maximum permissible drying temperature of a solvent in the drying material. Therefore, deactivate the week program timer if you do not use it (default setting, setting in the User level, chap. 10).

EX	**DANGER**
	Exceeding the ignition temperature of a solvent after the program ends. **Risk of fire and explosion.** **Danger of death.** ➢ Deactivate the week program timer if you do not use it.

7. Week program editor

The Week program editor allows defining up to 4 shift point for each week day. A shift point defines a moment and the switching state ON or OFF of the channels that become active in this instance.

Channel function:

- Channel 1 On = Set-point SP2 is equilibrated.
- Channel 1 Off = Set-point SP1 is equilibrated
- Channel 2 = reserve

	The week program timer is initially set to inactive (factory setting). Therefore, you need to activate the week program timer in the user level (chap. 10).

Normal Display

Display 1 shows	e.g. 39.8 °C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time, actual state of week program timer channel 1: Off, channel 2: Off)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	e.g. 0000	
Display 2 shows	PROGRAM EDITOR	(you are in the “program editor”)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	0000	Menu visible only if week program timer is activated in the user level (chap. 10)
Display 2 shows	WEEK PROG. EDITOR	(you are in the “week program editor”)

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	UserCod? 0000	(enter the user code, display flashes)

Enter the user code using arrow keys [▼] [▲] ↓ e.g. **0001** (basic setting, adjustable in the user level, chap. 10).
Value is shown in both displays.

Automatically forward after 2 sec

Display 1 shows	0000	
Display 2 shows	Monday	(selection of day of the week) (actual selection: Monday)

Select the day of the week (Monday up to Sunday) with key [X/W] ↓ Day of the week is shown in display 2.

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	Shiftpt.	(no function)

Press program key

Display 1 shows	0000	
Display 2 shows	Shiftpt. 1	(selection of the shift point) (actual shift point: 1)

Select the shift point (1 up to 4) with key → Value is shown in display 2.

Press program key

Display 1 shows	e.g. --.--	(time of the selected shift point)
Display 2 shows	S1: --:--	(actual selection of the shift point: S1) (actual setting: shift point not programmed)

Press program key

Display 1 shows	--.--	(time of the selected shift point)
Display 2 shows	Time --:--	(entry of the time of the selected shift point) (actual setting: shift point not programmed)

Enter the time (hh:mm) using arrow keys → Value is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	Ch1 = SP2: Off	(entry of the state of channel 1) (actual setting: Off)

Enter the state of channel 1 (On or Off) using arrow keys → Setting is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	Channel 2: Off	(entry of the state of channel 2) (no function) (actual setting: Off)

Enter the state of channel 2 (On or Off) using arrow keys → Setting is shown in display 2.

Press key → | Press key “**EXIT**” →

Display 1 shows	e.g., 08.30	(time of the selected shift point)
Display 2 shows	S1: 08:30 - -	(actual selection of the shift point: S1) (actual setting: time 08.30, channels Off)

Press program key → Select the next shift point

Press key “**EXIT**” twice → Select the next day of the week

To exit the menu, press several times key “**EXIT**” or wait for 120 seconds. The controller returns to normal display.

7.1 Program table template for the Week Program Editor

Program editor	
Program title	
Project	
Date:	

Day of the week	**Time**			**Channel 1 (temperature)**	**Channel 2***
	hh:mm	AM	PM	ON = SP2 OFF = SP1	ON OFF
Monday	S1				
	S2				
	S3				
	S4				
Tuesday	S1				
	S2				
	S3				
	S4				
Wednesday	S1				
	S2				
	S3				
	S4				
Thursday	S1				
	S2				
	S3				
	S4				
Friday	S1				
	S2				
	S3				
	S4				
Saturday	S1				
	S2				
	S3				
	S4				
Sunday	S1				
	S2				
	S3				
	S4				

- Channel 2 is non-functional in the standard unit

7.2 Programming example of the Week program editor

7.2.1 Desired time function

During the day (12 hours) the oven shall maintain a temperature of +80 °C / *176°F*, and during the night (12 hours) it shall cool down / stop heating (set-point 30 °C / *86°F*).

This program shall automatically run during the whole year, i.e. it shall be programmed just once.

7.2.2 Proceeding overview

1. **Settings in the User level (see chap. 10)**
   - **Activating the week program timer**
   - **Checking and, if necessary, setting the real time clock**

2. **Enter the set-points for the week program in "Fixed value entry mode" (see chap. 6)**

   Set-points for the example program:

   SP1 (night / weekend) = 30 °C (Channel 1 ON = Controller adjusts to set-point SP2)

   SP2 (day / week) = 80 °C (Channel 1 OFF = Controller adjusts to set-point SP1)

3. **Enter the time program to the program editor**

   Program table for the example program:

Day of the week	Time			Channel 1 (temperature)
	hh:mm	AM	PM	ON = SP2 (day) OFF = SP1 (night)
Monday	S1 06:00			ON
	S2 18:00			OFF
Tuesday	S1 06:00			ON
	S2 18:00			OFF
Wednesday	S1 06:00			ON
	S2 18:00			OFF
Thursday	S1 06:00			ON
	S2 18:00			OFF
Friday	S1 06:00			ON
	S2 18:00			OFF
Saturday	S1 06:00			ON
	S2 18:00			OFF
Sunday	S1 06:00			ON
	S2 18:00			OFF

Make sure that no other shift points have been pre programmed. If so, they must be deleted:
Set the time of the respective shift point to " --:-- " using key ▼.

7.2.3 Proceeding in detail

1. Settings in the user level

- **Activating the week program timer**
- **Checking and, if necessary, setting the real time clock**

Normal Display

Display 1 shows	e.g. 39.8 °C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time, actual switching state of week program timer channel 1: Off, channel 2: Off)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	e.g. 0000	
Display 2 shows	PROGRAM EDITOR	(you are in the “program editor”)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	0000	Menu visible only if week program timer is activated.
Display 2 shows	WEEK PROG. EDITOR	(you are in the “week program editor”)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	0000	
Display 2 shows	USER – LEVEL	(you are in the user level)

Press program key [⟳] ↓

Display 1 shows	0000	
Display 2 shows	UserCod? 0000	(enter the user code, display flashes)

Enter the user code using arrow keys [▼][▲] ↓ e.g. **0001** (basic setting, or the valid code in case it has been previously changed in this menu).
Value is shown in both displays.

Automatically forward after 2 sec

Display 1 shows	1	(actual address)
Display 2 shows	Adress 1	(entry of unit address) (actual address: 1)

Press several times key [X/W] ↓ until **Prog.Clk** appears:

Display 1 shows	0000	
Display 2 shows	Prog.Clk Active	(Week program timer active or inactive? (actual setting: Active)

Select “**Active**” using arrow keys [▼][▲] ↓ Setting is shown in display 2.

Press key [X/W] ↓

Display 1 shows	0000	
Display 2 shows	12h/24h 24h	(Display mode 12 hours or 24 hours? (actual setting: 24h)

Press key [X/W] ↓

Display 1 shows	0000	
Display 2 shows	Date	(Main menu: Setting the date of the real time clock)

Press program key [⟳] ↓

Display 1 shows	e.g. 2006	(Actual setting: 2006)
Display 2 shows	Year 2006	(Setting the year of the real time clock)

Set **year** (2006 up to 2050) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	e.g. 5	(Actual setting: may)
Display 2 shows	Month 5	(Setting the month of the real time clock)

Set **month** (1 up to 12) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	e.g. 15	(Actual setting: 15)
Display 2 shows	Day 15	(Setting the day of the real time clock)

Set **day** (1 up to 31) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key "**EXIT**" ↓

Press key X/W ↓

Display 1 shows	0000	
Display 2 shows	Time	(Main menu: Setting the time of the real time clock)

Press "program" key ↓

Display 1 shows	e.g. 13	(Actual setting: 13, i.e. 1 p.m.)
Display 2 shows	Hour 13	(Setting the hour of the real time clock)

Set **hour** (0 up to 23) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	e.g. 30	(Actual setting: 30 minutes)
Display 2 shows	Minute 30	(Setting the minute of the real time clock)

Set **minute** (0 up to 59) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press several times key "**EXIT**" ↓ or wait for 120 seconds

Controller returns to normal display.

2. Enter the set-points for the week program in Fixed value entry mode (see chap. 6)

Set-points for the example program:

SP1 (night / weekend) = 30 °C (Channel 1 ON = Controller adjusts to set-point SP2)

SP2 (day / week) = 80 °C (Channel 1 OFF = Controller adjusts to set-point SP1)

Normal Display

Display 1 shows	e.g. 39.8 °C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time, actual switching state of week program timer channel 1: Off, channel 2: Off)

Press key X/W ↓

Display 1 shows	30.0 °C	(actual temperature set-point 1)
Display 2 shows	SP1 TEMPERATURE	(variable: temperature in °C)

Enter temperature set-point **30 °C** using arrow keys ▼ ▲ ↓ Value is shown in display 1.

Press key [X/W] ↓

Display 1 shows	80.0 C	(actual temperature set-point 2)
Display 2 shows	SP2 TEMPERATURE	(variable: temperature in °C)

Enter temperature set-point **80 °C** using arrow keys [▼][▲] ↓ Value is shown in display 1.

Press the **EXIT** button. The controller changes to Normal Display.

3. Enter the time program to the week program editor

Normal Display

Display 1 shows	e.g. 39.8 C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time, actual state of week program timer channel 1: Off, channel 2: Off)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	e.g. 0000	
Display 2 shows	PROGRAM EDITOR	(you are in the program editor)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	0000	
Display 2 shows	WEEK PROG. EDITOR	(you are in the week program editor)

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	UserCod? 0000	(enter user code, display flashes)

Enter the user code using arrow keys [▼][▲] ↓ e.g. **0001** (basic setting, adjustable in the user level, chap. 10).
Value is shown in both displays.

Automatically forward after 2 sec

Display 1 shows	0000	
Display 2 shows	Monday	(selection of day of the week) (actual selection: Monday)

Select the first day of the week (**Monday**) with key [X/W] ↓ Day of the week is shown in display 2.

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	Shiftpt.	(no function)

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	Shiftpt. 1	(selection of the shift point) (actual shift point: 1)

Select shift point **1** with key [X/W] ↓ Value is shown in display 2.

Press program key [↻] ↓

Display 1 shows	e.g. --.--	(time of the selected shift point)
Display 2 shows	S1: --:--	(actual selection of the shift point: S1) (actual setting: shift point not programmed)

Press program key [↻] ↓

Display 1 shows	06.00	(time of the selected shift point)
Display 2 shows	Time 06:00	(entry of time of the selected shift point) (actual setting: 6.00, i.e. 6 a.m.)

Enter the time **06:00** using arrow keys ▼ ▲ ↓ Value is shown in display 2.

Press key X/W ↓

Display 1 shows	0000	
Display 2 shows	Ch1 = SP2: On	(entry of state of channel 1) (actual setting: On)

Enter the state of channel 1 **On** using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key **EXIT** ↓

Display 1 shows	06.00	(time of the selected shift point)
Display 2 shows	S1: 06:00 □ -	(actual selection of the shift point: S1) (actual setting: time 06.00, channel 1 ON)

Press program key ↻ ↓ to **select the next shift point**

Display 1 shows	0000	
Display 2 shows	Shiftpt.	(no function)

Press program key ↻ ↓

Display 1 shows	0000	
Display 2 shows	Shiftpt. 2	(selection of the shift point) (actual shift point: 2)

Select shift point **2** with key X/W ↓ Value is shown in display 2.

Press program key ↻ ↓

Display 1 shows	e.g. --.--	(time of the selected shift point)
Display 2 shows	S2: --:--	(actual selection of the shift point: S2) (actual setting: shift point not programmed)

Press program key ↻ ↓

Display 1 shows	18.00	(time of the selected shift point)
Display 2 shows	Time 18:00	(entry of time of the selected shift point) (actual setting: 18.00, i.e. 6 p.m.)

Enter the time **18:00** using arrow keys ▼ ▲ ↓ Value is shown in display 2.

Press key X/W ↓

Display 1 shows	0000	
Display 2 shows	Ch1 = SP2: Off	(entry of state of channel 1) (actual setting: Off)

Enter the state of channel 1 **Off** using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key **EXIT** ↓

Display 1 shows	18.00	(time of the selected shift point)
Display 2 shows	S2: 18:00 - -	(actual selection of the shift point: S2) (actual setting: time 18.00, channel 1 OFF)

Press key EXIT twice ↓ to **select the next day of the week**

Display 1 shows	0000	
Display 2 shows	Tuesday	(selection of day of the week) (actual selection: Tuesday)

Select the next day of the week (**Tuesday**) with key [X/W] ↓ Day of the week is shown in display 2.

Press program key [⟳] ↓

Display 1 shows	0000	
Display 2 shows	Shiftpt.	(no function)

Press program key [⟳] ↓

Display 1 shows	0000	
Display 2 shows	Shiftpt. 1	(selection of the shift point) (actual shift point: 1)

Select shift point **1** with key [X/W] ↓ Value is shown in display 2.

Press program key [⟳] ↓

Display 1 shows	e.g. --.--	(time of the selected shift point)
Display 2 shows	S1: --:--	(actual selection of the shift point: S1) (actual setting: shift point not programmed)

Press program key [⟳] ↓

Display 1 shows	06.00	(time of the selected shift point)
Display 2 shows	Time 06:00	(entry of time of the selected shift point) (actual setting: 6.00, i.e. 6 a.m.)

Enter the time **06:00** using arrow keys [▼][▲] ↓ Value is shown in display 2.

Press key [X/W] ↓

Display 1 shows	0000	
Display 2 shows	Ch1 = SP2: On	(entry of state of channel 1) (actual setting: ON)

Enter the state of channel 1 **On** using arrow keys [▼][▲] ↓ Setting is shown in display 2.

Press key **EXIT** ↓

Display 1 shows	06.00	(time of the selected shift point)
Display 2 shows	S1: 06:00 ▯ -	(actual selection of the shift point: S1) (actual setting: time 06.00, channel 1 ON)

Press program key [⟳] ↓ to **select the next shift point**

etc.

Following entry of the complete program:

Press several times key **EXIT** ↓ or wait for 120 seconds

Controller returns to normal display.

8. Program editor

8.1 Selecting between set-point ramp and set-point step

You can program various kinds of temperature transitions. In the user level (chap. 10) you can select between the settings “Ramp” (default setting) and “Step”.

	Setting “Ramp” allows programming all kinds of temperature transitions. With setting “Step” the controller will equilibrate only to constant temperatures; programming ramps is no longer possible.

	Switching between settings “Ramp” and “Step” will influence all programs. Please note that this can cause the time courses of existing programs to change significantly.

8.1.1 Programming with setting “Ramp” (default setting)

Set-points always refer to the start of a program section, i.e., at the beginning of each program section, the entered set-point is reached. During program section operation, the temperature gradually passes to the set-point entered for the subsequent program section.

You can program all kinds of temperature transitions by the appropriate design of the program section timing:

- **Gradual temperature changes “set-point ramp“**

  The set-point gradually moves from one set-point to the one of the following program section during a given interval. The actual temperature value (X) follows the continually moving set-point (W) at any time.

  Temperature ramps can be programmed in order to extend the heating up times. This may be necessary in order to avoid temperature stresses in the material during the heating up phase. Heating up times can be considerably slowed down by the use of temperature ramps.

- **Program sections with constant temperature**

  The initial values of two subsequent program sections are identical; therefore the temperature remains constant during the whole time of the first program section.

- **Sudden temperature changes “set-point step”**

  Steps are temperature changes (ramps) that occur during a very short interval. Two program sections with an identical set-point are followed by a section with a different set-point. If the duration of this transitional program section is very short (minimum entry 1 min), the temperature change will proceed rapidly in the minimum amount of time.

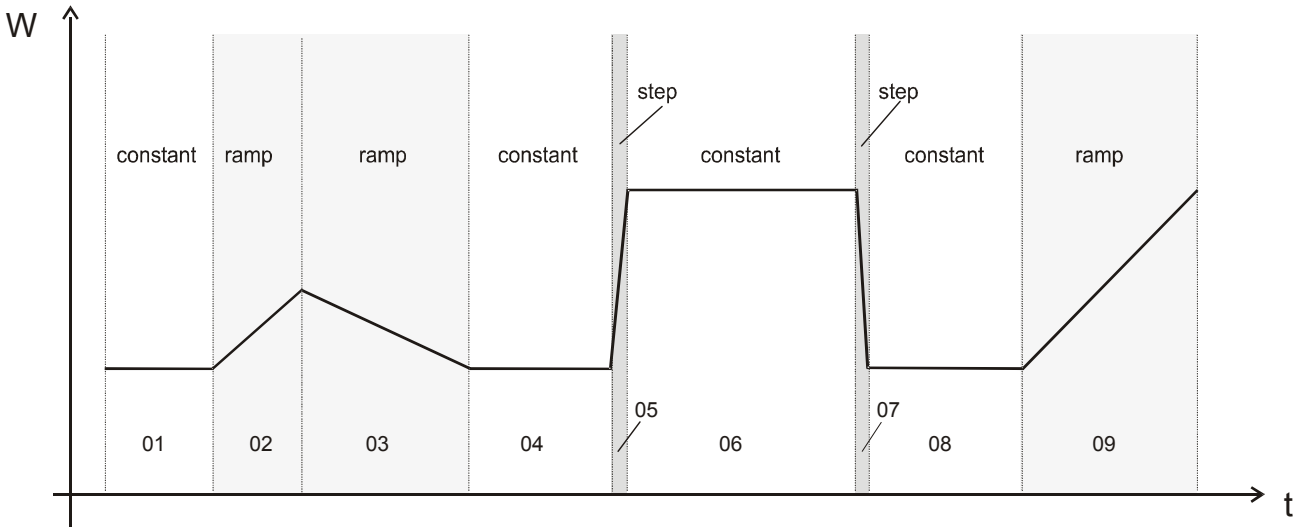
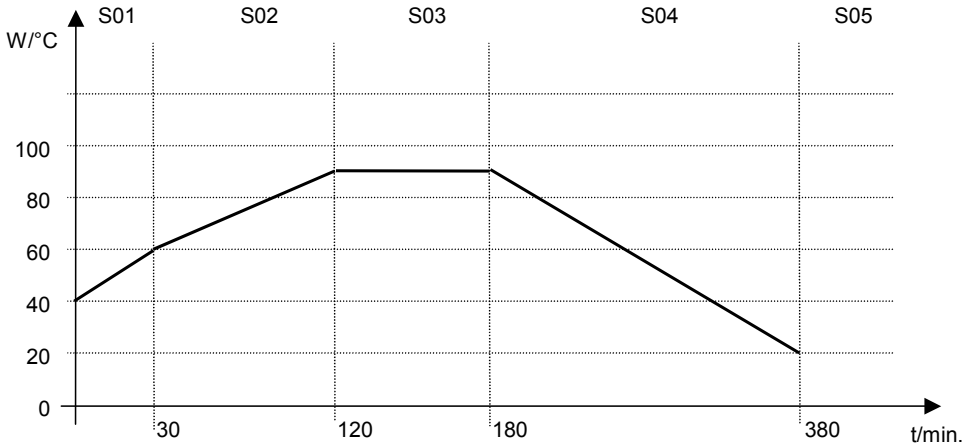


Figure 13: Possible temperature transitions
(with default setting “ramp” in the user level (chap. 10)

	A heating up rate of 1.5 °C/min can be regarded as the realistic maximum.

	If the oven is charged to full capacity, depending on the load, deviations from the specified heating up times may occur.

Program entry as set-point ramp (example):

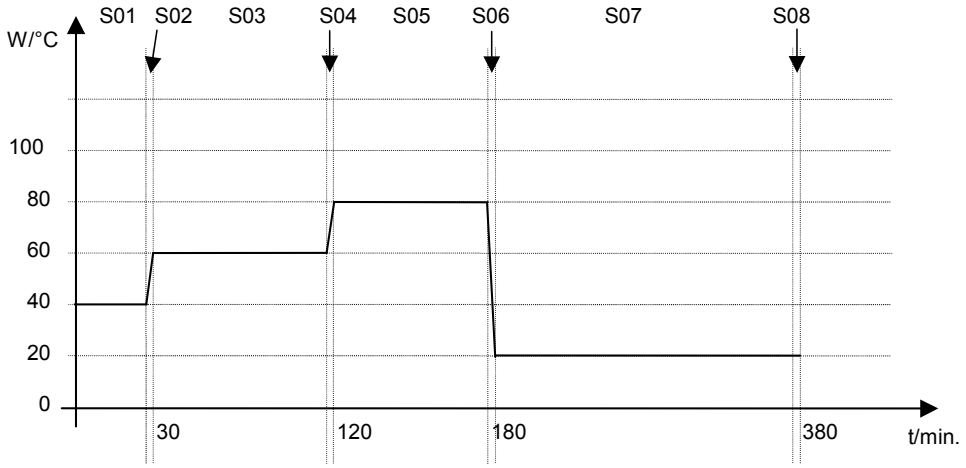


Program table corresponding to the diagram (with default setting “Ramp”):

Section SEC	Temperature set-point [°C] TEMP	Section length [hh.mm] TIME
S01	40	00:30
S02	60	01:30
S03	90	01:00
S04	90	03:20
S05	20	00:01

You can now enter the values of such a program table to the RD3 program controller (chap. 8.2).

Program entry as set-point step (example):



Program table corresponding to the diagram (with default setting “Ramp”):

Section SEC	Temperature set-point [°C] TEMP	Section length [hh.mm] TIME
S01	40	00:30
S02	40	00:01
S03	60	01:30
S04	60	00:01
S05	80	01:00
S06	80	00:01
S07	20	03:20
S08	20	00:01

You can now enter the values of such a program table to the RD3 program controller (chap. 8.2).

Program the end point of the desired cycle with an additional section (in our examples S05 for set-point ramp and S08 for set-point step) with a section time of at least one minute. Otherwise, the program will stop one section too early because the program line is incomplete.

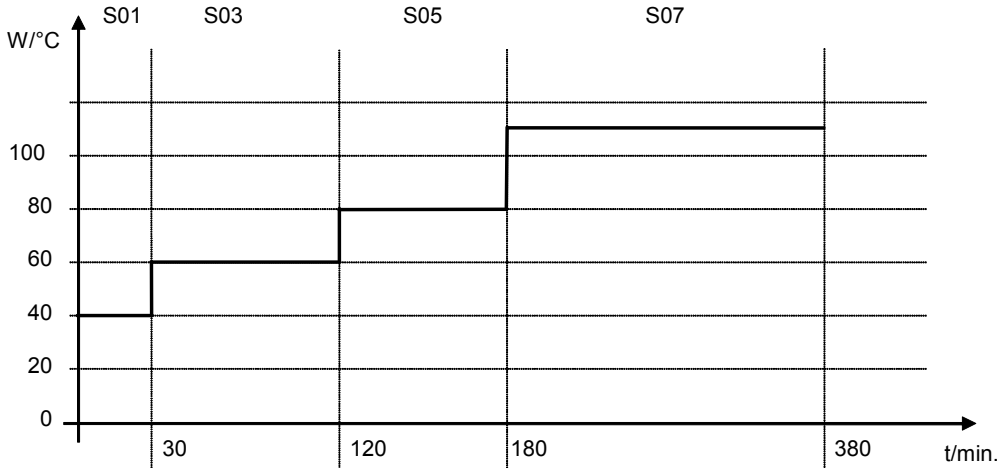
8.1.2 Programming with setting “step”

With setting “Step” selected, you don’t need to program the transition section in the Program Editor.

	With setting “step” the controller will equilibrate only to constant temperatures; programming ramps is no longer possible.

The set-points are maintained constant for the duration of a program section. At the start of each program section, the unit heats up with the maximum speed in order to attain the entered set-point

Program entry as set-point step (example):



Program table corresponding to the diagram (with setting “Step”):

Section SEC	Temperature set-point [°C] TEMP	Section length [hh.mm] TIME
S01	40	00:30
S02	60	01:30
S03	80	01:00
S04	20	03:20

You can now enter the values of such a program table to the RD3 program controller (chap. 8.2).

8.1.3 General notes on programming temperature transitions

When exceeding the tolerance limits set in the user level (chap. 10), the program is interrupted until the actual temperature value returns to within the tolerance range. During this program interruption, the LED (7d) flashes. Therefore, the duration of the program may be extended due to the programming of tolerances

The programming is saved even in case of a power failure or after turning off the unit.

Solvents and the resulting vapors can ignite at excessive drying temperatures.

DANGER

Excess drying temperature.

Ignition and explosion hazard.

- Determine the maximum drying temperature in relation to the ignition temperature of the solvent according to the information panel “Temperature setting” (chap. 2.5). Do NOT exceed this temperature when presetting the set point on the RD3 temperature controller.
- In the case of solvent mixtures, use the ignition temperature of the material with the lowest ignition temperature.
- Before starting the drying process, set the temperature safety device (chap. 12) to the permitted maximum drying temperature according to the information panel “Temperature setting” (chap. 2.5).
- The heating is only released when a vacuum of 125 ± 25 mbar / *3.69 ± 0.74 inHg*) or below is reached. Only then should you start the program.

After program rundown the controller returns to fixed value operation showing Normal Display and equilibrates to the temperature value previously entered in fixed value entry mode.

	Before starting the program, check the set-point value entered in fixed value entry mode. After program rundown temperature will equilibrate to this value.

	Deactivate the week program timer (factory setting, setting in the user level, chap. 10) before starting a program.

8.2 Set-point entry for program operation

From Normal Display, press down button X/W for 5 sec to access the program editor. Then enter the set-points one after the other in all program sections of a selected program.

You can enter two programs with up to 10 sections each or one program with up to 20 sections (setting in the user level, chap. 10).

In order to avoid incorrect programming, we recommend entering the values of the program course into a table (template in chap. 8.3).

Example of program table (with default setting “Ramp”):

Section SEC	Temperature set-point [°C] TEMP	Section length [hh.mm] TIME
S01	40	00:30
S02	60	01:30
S03	90	01:00
S04	90	03:20
S05	20	00:01

You can now enter the values of the program table to one of the program places of the RD3 program controller.

Step 1 – Selecting the program and the first program section to be entered:

Normal Display

Display 1 shows	e.g. 39.8 °C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time, actual switching state of week program timer channel 1: Off, channel 2: Off)

Press down key [X/W] ↓ for 5 sec.

Display 1 shows	e.g. 0000	
Display 2 shows	PROGRAM EDITOR	(you are in the program editor)

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	UserCod? 0000	(enter user code)

Enter user code using arrow keys [▼][▲] ↓ e.g. **0001**
(basic setting, adjustable in the user level, chap. 10).
Value is shown in both displays.

Automatically forward after 2 sec.

↓

Display 1 shows	e.g. 01	(program P01 selected)
Display 2 shows alternating	--- : --- PRG.	(program can be selected)
	CONTINUE X/W	(information: to 1st program section with X/W)

Select program P01 or P02 using arrow keys [▼][▲] ↓ Value is shown in display 1.

Press key [X/W] ↓

In the selected program P01 or P02, program sections can be selected:

Display 1 shows	e.g. 01	(section S01 selected)
Display 2 shows alternating	P01: --- SEC.	Section S01 has already been created. Enter new set-points for the individual variables with button X/W
	CONTINUE X/W	

or:

Display 1 shows	e.g. 01	(section S01 selected)
Display 2 shows alternating	P01: --- SEC.	Section S01 has not yet been created. Enter set-points for the individual variables with button X/W
	NEW SEC. X/W	

Select sections S01 to S10 or to S20 using arrow keys [▼][▲] ↓

As long as no program section has been entered, the display switches back to 01 in case of any entry > 01, because all sections need to be entered one after the other, and each new section is created as NEWSEC.

Example: If three program sections have been already entered, the next section to be entered is S04. Before this, no section > S04 can be selected.

↓

Next step –set-point entry in the desired program sections:

Basic entry principle: Access the parameters of individual program sections with button X/W one after the other. Enter the values of the individual parameters with the arrow keys. A value flashing once after 2 seconds indicates that it has been adopted by the controller. If several parameters are to be skipped (e.g. in order to change a parameter in a posterior program section), the parameters can be rapidly jumped over by holding down the X/W key. If no button is pressed for more than 120 sec the controller switches back to Normal Display. The program entered to this point remains stored.

Press key [X/W] ↓

Display 1 shows	e.g. 40.0°C	(actual temperature set-point)
Display 2 shows alternating	S01: TEMP 40.0	(variable: temperature in °C)
	CONTINUE X/W	(information: go on with X/W)

Enter temperature set-point of S01 in °C using arrow keys [▼][▲] ↓

Press key [X/W] ↓

Display 1 shows	e.g. 00.30	(actual section length set-point)
Display 2 shows alternating	S01: TIME 00:30	(variable: section length in hh:mm)
	CONTINUE X/W	(information: go on with X/W)

Enter section length set-point of S01 in hh.mm using arrow keys [▼][▲] ↓ Value is shown in both displays.

Press key [X/W] ↓

Selecting the next program sections to be entered

Display 1 shows	e.g. 02	(section S02 selected)
Display 2 shows alternating	P01: --- SEC.	Section S02 has already been created. Enter new set-points for the individual parameters with X/W.
	CONTINUE X/W	

or:

Display 1 shows	e.g. 02	(section S02 selected)
Display 2 shows alternating	P01: --- SEC.	Section S02 has not yet been created. Enter set-points for the individual parameters with X/W
	NEW SEC. X/W	

Select the next section to be entered using arrow keys [▼][▲] ↓

Display 1 shows	e.g. 60.0°C	(actual temperature set-point)
Display 2 shows alternating	S02:TEMP 60.0	(variable: temperature in °C)
	CONTINUE X/W	(information: go on with X/W)

Enter the temperature set-point of S02 in °C using arrow keys [▼][▲] ↓

Etc.

If all sections up to S10 or up to S20 have been programmed, section S01 follows again. In order to quit the entry mode, press the "**EXIT**" button several times or wait 120 sec. → the controller will then return to Normal Display.

☞	When changing the set-point, check the setting of the safety device (chap. 12).

8.3 Program table template

Program editor	
Program title	
Project	
Program No.	
Date:	

Section **SEC**	Temperature set-point [°C] **TEMP**	Section length [hh.mm] **TIME**
S01		
S02		
S03		
S04		
S05		
S06		
S07		
S08		
S09		
S10		
S11		
S12		
S13		
S14		
S15		
S16		
S17		
S18		
S19		
S20		

8.4 Deleting a program section

A program section is deleted from the program by setting the section duration to Zero.

→ **Normal display**

Press down key [X/W] ↓ for 5 sec.

Display 1 shows	e.g. 0000	
Display 2 shows	PROGRAM EDITOR	(you are in the program editor)

Press program key [↻] ↓

Display 1 shows	0000	
Display 2 shows	UserCod? 0000	(enter user code)

Enter the user code using arrow keys [▼][▲] ↓ e.g. **0001** (basic setting, adjustable in the user level, chap. 10).
Value is shown in both displays.

Automatically forward after 2 sec

Display 1 shows	e.g. 01	(program P01 selected)
Display 2 shows	--- : --- PRG.	(program can be selected)
alternating	CONTINUE X/W	(information: to 1st program section with X/W)

Select the desired program, e.g. P01, using arrow keys [▼][▲] ↓ Value is shown in display1.

Press key [X/W] ↓

In the selected program P01 or P02, program sections can be selected:

Display 1 shows	e.g. 01	(actual selection of the section: S01)
Display 2 shows	P01: --- SEC.	(program section can be selected)
alternating	CONTINUE X/W	(information: set-point entry with X/W)

Select desired section, e.g. S03, using arrow keys [▼][▲] ↓ (omitted if section S01 shall be deleted).

Press key [X/W] ↓

Display 1 shows	e.g. 90.0°C	(actual temperature set-point)
Display 2 shows	S03:TEMP 90.0	(variable: temperature)
alternating	CONTINUE X/W	(information: continue with X/W)

No entry ↓

Press key [X/W] ↓

Display 1 shows	e.g. 01.00	(actual section length)
Display 2 shows	S03:TIME 01:00	(variable: section length)
alternating	CONTINUE X/W	(information: continue with X/W)

Enter set-point **Zero** for section length in hh:mm of S03 using arrow keys [▼][▲] ↓ Value is shown in display 2 or in both displays (display depends on maximum time setting in the user level chap. 10)

Display 1 shows	e.g. 00.00	(actual section length)
Display 2 shows	S03:TIME 00:00	(variable: section length)
alternating	DELETE SEC. X/W	(information: delete section with X/W)

Press key [X/W] ↓

The following section (in our example now S03) is displayed:

Display 1 shows	e.g. 03	(actual selection of the section: S03)
Display 2 shows alternating	P01:S03	(program section can be selected)
	CONTINUE X/W	(information: set-point entry with X/W)

Press key "**EXIT**" or wait 120 sec

Controller returns to Normal Display

	If you delete a program section which is followed by further sections, those following move up in place of the deleted section.

In our example, section S03 has been deleted. If sections S04, S05, etc. have been programmed earlier, they will now replace the preceding sections, i.e., S04 is now called S03 etc.

Deletion leads to overwriting the section by the following one. It is therefore not possible to temporarily inactivate a program section. To enter a section later to a program, all the sections following the new one must be entered again.

9. Program start level

Before starting the program, check the set-point entered in Fixed value operation mode. After end of the program, the temperature will equilibrate to this value. This value must NOT exceed the maximum permissible drying temperature of a solvent contained in the drying material.

EX	**DANGER**
	Exceeding the ignition temperature of a solvent after the program ends. **Risk of fire and explosion.** **Danger of death.** ∅ Set-point of Fixed value operation must NEVER reach the ignition temperature of a contained solvent. For safety reasons, always ensure that there is a safety margin (chap. 2.5). ➢ Check the set-point of Fixed value operation and if necessary adapt it acc. to the temperature setting information panel (chap. 2.5).

After the program ends, the temperature will equilibrate to the set-point entered in Fixed value operation mode. If the week program timer is active, another set-point (SP2) may be targeted according to programming. Too high temperatures can occur which exceed the maximum permissible drying temperature of a solvent contained in the drying material. Deactivate the week program timer before starting the program (default setting, setting in the User level, chap. 10).

EX	**DANGER**
	Exceeding the ignition temperature of a solvent after the program ends. **Risk of fire and explosion.** **Danger of death.** ➢ Deactivate the week program timer before starting the program.

In the first step, select a program. This is on condition that a program has been entered previously (chap. 8.2) and that program type “2 programs with 10 sections each” has been selected in the user level (chap. 10).

Then define the settings for the program course. Two parameters can be set:

- Program delay time, i.e. a defined time before a program starts. It can be entered with a precision of 1 minute, and its maximum value is 99.59 (99 h 59 min). If the value is 00.00, the program will start immediately.
- Number of program cycles, i.e. the desired number of program repeats. Values from 1 to 99 can be entered. If the program is not going to be repeated, enter the value “0”. For indefinite repeats enter the value “–1”. The program is repeated as a whole; it is not possible to repeat individual sections.

In the last step start the selected program. These steps must be carried out subsequently.

	Deactivate the week program timer (factory setting, setting in the user level, chap. 10) before starting a program.

Step 1 – Program selection (only with program type “2 programs” set)

Normal Display

Press program key

Display 1 shows	e.g. 1	(actual selection of the program)
Display 2 shows	SEL.PRG.	(select program 1 or 2)

Enter program number 1 or 2 with arrow keys Value is shown in display 1.

Next step – entry of program course settings

Press program key

Display 1 shows	e.g. 00.00	(entered delay time hh.mm)
Display 2 shows	RUN TIME	(enter delay time of program start)

Set delay time in hh.mm using arrow keys Value is shown in display 1.

Press program key

Display 1 shows	e.g. -1	(actual selection of the number of program cycles)
Display 2 shows	REPEAT	(enter number of program cycles)

Select number of cycles -1, 0, 1 etc. using arrow keys Value is shown in display 1.

Last step – program start

Press program key

Display 1 shows	e.g. 1	(selected program)
Display 2 shows	RUN PRG.	(Question: start selected program?)

Press program key

Display 1 shows	e.g. 25.5 °C	actual temperature value
Display 2 shows	P01:S01 00:29:39 (time running backwards)	(actual program P01, actual section S01, and remaining time of program section S01)

Program is running. The green LED (7d) lights up.

In addition to the green LED (7d) indicating a running program, the LED (7a) is lit if the heating is active, or not lit if the actual temperature equals the set-point.

During program course the arrow keys and the "**EXIT**" button are not functional.

By pressing program key for 3 seconds, you can terminate the program course.

If you press button during program course, the entered set-point of the actually running program section is shown for 5 sec:

Display 1 shows	e.g. 65.5 °C	(actual temperature value)
Display 2 shows	P01:S03 00:47:12	(actual program P01, actual section S03, and remaining time of program section S03)

Press key

Display 1 shows	e.g. 90 °C	(actual temperature set-point 1)
Display 2 shows	SP1 TEMPERATURE	

5 seconds

Display 1 shows	e.g. 30 °C	(actual temperature set-point 2)
Display 2 shows	SP2 TEMPERATURE	(no function during program operation)

5 seconds

After program rundown (and, if appropriate, of the program repeats) the controller returns to fixed value operation showing Normal Display and equilibrates to the temperature value previously entered in fixed value entry mode.

10. User level

In this menu you can set the following parameters (in brackets the corresponding abbreviated information given in display 2):

- **Unit address** (Adress)

  Setting of controller address (1 to 255) for operation with the communication software APT-COM™.

- **User code** (User-cod)

  Modification of the user code setting (factory setting 0001) for access to the user level and the program editor.

	Keep in mind any modification of the user code. There is no access to these levels without a valid user code.

- **Decimal point position** (Decimal)

  Selection if integer values or one position after the decimal point can be entered. The integer representation is shown in Display 2 (set-point entry) while the actual value in Display 1 is always shown with one decimal point.

- **Audio alert** (Buzzer)

  Inactive: no audible signal (buzzer) in case of an alarm event.

  Active: in case of an alarm event (see chap. 11.2) an audible signal (buzzer) will sound. It can be reset by pressing the "**EXIT**" button.

- **Selection of controller menu language** (Language)

  German, **English**, or **French** can be selected.

- **Counter of operating hours** (Oper.hs)

  Information about the number of operating hours currently reached or since the last reset (no setting, display only).

- **Max. number of operating hours** (Op.limit)

  Entry of a limit number of operating hours, i.e., the maximum number of operating hours that can be run. Maximum setting: 9999. Reaching the limit has no effect.

- **Reset operating hours** (Op.back)

  Reset operating hours to zero.

- **Interface protocol** (Protocol)

  "**Modbus**": The unit interface can be used as a communication interface to connect it to a computer. This serves to control the unit by the communication software APT-COM™. It is possible to read and write the values of all parameters.

  "**Printer**": A protocol printer (option) for data printouts can be connected to the unit interface. At the printer the actual temperature value is regularly protocolled with fixed formatting and with adjustable print intervals (see chap. 15.8).

  In both cases an interface converter RS 422 / RS 232 is used.

- **Print interval** (Prt.-Inv.)

  Setting of the print interval in minutes. Function is available only if setting "Printer" has been selected in the previous menu point.

- **Display illumination** (Disp.LED)

  Selection between continuous display illumination and limited illumination that will automatically go off 300 sec. after the last entry.

- **Program type selection** (PrgSelec)

  Select between entry of two programs with up to 10 sections each or of one program with up to 20 sections.

	When changing from 2 programs to 1 program or vice-versa, existing programs are deleted in the program editor!

- **Maximum section duration** (Prg.Time)

  The maximum length of an individual program section can be set to either 99 h 59 min or to 999 h 59 min. This setting is then valid for all program sections.

	When changing the maximum duration setting, pre-existing programs will be deleted in the program editor.

- **Set-point programming type** (Setp.sim)

  Selection between “Ramp” and “Step”. With setting “Step” selected, you don’t need to program the transition section in the Program Editor.

	If you select setting “step”, the controller will equilibrate only to constant temperatures; programming ramps becomes impossible.

	A change between settings “ramp” and “step” will influence all programs. Note that significant change in time courses may arise in existing programs.

- **Tolerance limit range** (Tol.band)

  Entry of a tolerance limit value in °C. If the actual value of temperature exceeds the set-point of a program section by more than the entered tolerance limit value, the program is halted (LED (7d) flashes) until the actual temperature value is again within the tolerance range

  Entry of “0” means tolerance limits are off.

- **Activating or inactivating the week program timer** (Prog.Clk)

  “**Inactive**”: The week program timer is turned off (factory setting). The corresponding setting menu (chap. 7) is not visible, nor is set-point 2 in the “Fixed value entry mode” (chap. 6).

  “**Active**”: The week program timer is activated.

	When deactivating the week program timer, any programming made in advance will remain in memory and take effect when the week program timer is activated again.

	Deactivate the week program timer before staring a program (chap. 9).

- **Display mode** (12h/24h)

  Select between 12 hours (display “AM” or “PM”) or 24 hours.

- **Date of the real time clock** (Date)

  Main menu. Use the program key to access the settings of year, month, and day in the corresponding submenus.

  - **Year of the real time clock** (Year)

    Enter the year (2006 up to 2050)

  - **Month of the real time clock** (Month)

    Enter the month (1 up to 12).

  - **Day of the real time clock** (Day)

    Enter the day (1 up to 31).

- **Time of the real time clock** (Time)

  Main menu. Use the program key to access the settings of hour and minute in the corresponding sub-menus.

	There is no automatic switch between daylight saving time and regular time.

  - **Hour of the real time clock** (Hour)

    Enter the hour (0 up to 23).

  - **Minute of the real time clock** (Minute)

    Enter the minute (0 up to 59).

Normal Display

Display 1 shows	e.g. 39.8 °C	(actual temperature value)
Display 2 shows	e.g. 15.05.06 13:52 - -	(actual date and time, actual switching state of week program timer channel 1: Off, channel 2: Off)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	e.g. 0000	
Display 2 shows	PROGRAM EDITOR	(you are in the program editor)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	0000	Menu visible only if week program timer is activated.
Display 2 shows	WEEK PROG. EDITOR	(you are in the week program editor)

Press down key [X/W] ↓ for 5 sec

Display 1 shows	0000	
Display 2 shows	USER – LEVEL	(you are in the user level)

Press program key [⟳] ↓

Display 1 shows	0000	
Display 2 shows	UserCod? 0000	(enter user code, display flashes)

Enter the user code using arrow keys [▼][▲] ↓ e.g. **0001** (basic setting, or the valid code in case it has been previously changed in this menu). Value is shown in both displays.

Automatically forward after 2 sec

Display 1 shows	1	(actual address: 1)
Display 2 shows	Adress 1	(entry of unit address) (actual address: 1)

Enter the unit address (1 up to 254) using arrow keys [▼][▲] ↓ Address is shown in both displays.

Press key [X/W] ↓

Display 1 shows	1	(actually valid user code: 1)
Display 2 shows	User-cod 1	(change user code) (actually set: 1)

Enter a new value using arrow keys [▼][▲] ↓ Value is shown in both displays.

Press key

Display 1 shows	0000	(no function)
Display 2 shows	Saf.mode: Limit	(no function)

Press key

Display 1 shows	0	(no function)
Display 2 shows	Saf.setp 0	(no function)

Press key

Display 1 shows	0000	(no function)
Display 2 shows	Decimal: XXX.X	(setting of decimal point position) (actual setting: XXX.X)

Select decimal point position using arrow keys Decimal point position XXX.X or XXXX. is shown in display 2.

Press key

Display 1 shows	0000	(no function)
Display 2 shows	Buzzer : Active	(setting of the alarm buzzer) (actual setting: „Active“)

Select between “Active” and “Inactiv” using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	(no function)
Display 2 shows	Language : English	(selection of controller language) (actual setting: English)

Select between languages German, English, and French using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	e.g. 0004	(unit operating hours)
Display 2 shows	Oper.hs 0004:28	(operating hours up to now hhhh:mm) (actually shown: 4 hs 28 min)

Press key

Display 1 shows	1000	(actual setting: 1000 hs)
Display 2 shows	Op.limit 1000:00	(maximum number of operating hours hhhh:mm (actual setting: 1000 hs)

Set value using arrow keys Setting is shown in both displays.

Press key

Display 1 shows	0000	(no function)
Display 2 shows	Op.back : No	(reset counter of operating hours ?) (actual setting: No)

Select between “Yes” and “No” using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	(no function)
Display 2 shows	Protocol: MODBUS	(Selection of interface mode) (actual setting: Modbus)

Select between protocols “MODBUS” and “Printer” using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	e.g. 3	(actual setting: 3 min)
Display 2 shows	Prt-Inv. 3	(print interval) (actual setting: 3 min)

Select value between 0 and 255 minutes using arrow keys Setting is shown in displays 1 and 2.

Press key

Display 1 shows	0000	
Display 2 shows	Disp.LED: No	(continuous display illumination?) (actual setting: No)

Select between “Yes” and “No” using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	PrgSelec: 2Prg10S	(1 program with max. 20 sections or 2 programs with max. 10 sections each?) (actual setting: 2Prg10S)

Select between “2Prg10S” and “1Prg20S” using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	Prg.Time: 99:59	(max. section length 99:59 or 999:59?) (actual setting: 99:59)

Select between 99:59 in hh:mm or 999:59 in hhh:mm using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	Setp.sim Ramp	(ramp or step?) (actual setting: ramp)

Select between Ramp and Step using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	Tol.band 0	(Tolerance limits in °C) (actual setting: 0)

Set value in °C using arrow keys Setting is shown in display 2.

Press key

Display 1 shows	0000	
Display 2 shows	Prog.Clk Inactive	(Week program timer active or inactive? (actual setting: Inactive)

Select between “Active” and “Inactive” using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	0000	
Display 2 shows	12h/24h 24h	(Display mode 12 hours or 24 hours? (actual setting: 24h)

Select between 12 hours and 24 hours using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	0000	
Display 2 shows	Date	(Main menu: Setting the date of the real time clock)

↓ X/W

Press program key ↓

Display 1 shows	e.g. 2006	(Actual setting: 2006)
Display 2 shows	Year 2006	(Setting the year of the real time clock)

Set year (2006 up to 2050) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	e.g. 5	(Actual setting: may)
Display 2 shows	Month 5	(Setting the month of the real time clock)

Set month (1 up to 12) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	e.g. 15	(Actual setting: 15)
Display 2 shows	Day 15	(Setting the day of the real time clock)

Set day (1 up to 31) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key **EXIT** ↓

Press key X/W ↓

Display 1 shows	0000	
Display 2 shows	Time	(Main menu: Setting the time of the real time clock)

Press program key ↓

Display 1 shows	e.g. 13	(Actual setting: 13, i.e. 1 p.m.)
Display 2 shows	Hour 13	(Setting the hour of the real time clock)

Set hour (0 up to 23) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press key X/W ↓

Display 1 shows	e.g. 30	(Actual setting: 30 minutes)
Display 2 shows	Minute 30	(Setting the minute of the real time clock)

Set minute(0 up to 59) using arrow keys ▼ ▲ ↓ Setting is shown in display 2.

Press several times key **EXIT** ↓ or wait for 120 seconds

Controller returns to normal display.

11. Performance in case of failures

11.1 Performance after power failures

Power failure during fixed-value operation (Normal Display):

The entered parameters remain saved. After power returns, operation continues with the set parameters.

Power failure during program operation:

After the power returns, program course continues with the set-points that have been reached previously during program operation.

11.2 Alarm messages

Alarm messages, e g. “RANGE ERROR CH1” in case of sensor rupture, are shown in Display 2 only in Normal Display.

A buzzer can be activated / deactivated in the user level (chap. 10). It can be reset by pressing the “**EXIT**” button. The alarm text shown in Normal Display goes off only if the cause of the alarm does not exist any longer.

12. Safety device class 2 (DIN 12880)

The safety device protects the safety vacuum drying oven, its environment and the charging material from exceeding the maximum permissible temperature.

Please observe the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers’ liability insurance association) and BGR 104 (formerly ZH 1/10 laboratory guidelines issued by the employers’ liability insurance association) (for Germany).

Set the safety-device to the maximally permitted drying temperature according to the information panel “temperature setting” (chap. 2.5), to prevent exceeding the maximum drying temperature in case of a default. In the event of a fault in the temperature controller, the safety device (2) **permanently** turns off the safety vacuum drying oven. This status is reported visually by the indicator lamp (2a).

Check the operation of the safety device (2) by moving it slowly counter-clockwise until it is turned off. The safety device cut-off is reported visually by the indicator lamp (2a).

Then release the safety device by pressing the reset button (2b), and turn on the VDL safety vacuum drying oven as described previously.

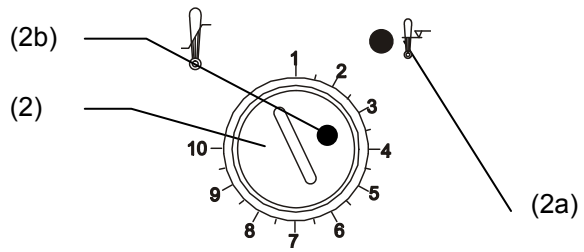


Figure 14: Temperature safety device class 2

Function:

The safety device is functionally and electrically independent of the temperature control device and turns off the unit at all poles.

If you turn the control knob (2) to its end-stop (position 10) the safety device will protect the appliance. If you set it to a temperature a little above the set-point temperature, it will protect the charging material.

If the safety device has turned off the oven, identifiable by the red alarm lamp (2a) lighting up, proceed as follows:

- Disconnect the oven from the power supply
- Have an expert examine and rectify the cause of the fault
- Release the safety device by pressing the reset button (2b)
- Restart the oven as described in chap. 5.

Adjustment:

To check the response temperature of the safety device, turn on the chamber and set the desired set point on the temperature controller.

The scale division from 1 to 10 corresponds to the temperature range from 30 °C / *86°F* up to 320 °C / *608°F* and serves as a setting aid.

- Turn the control knob (2) of the safety device using a coin to its end-stop (position 10) (unit protection).
- When the set point is reached, turn back the control knob (2) until its trip point (turn it counter-clockwise) is reached.
- The red alarm lamp (2a) lighting up identifies the trip point; and the reset button (2b) pops out.
- The optimum setting of the safety device is obtained by turning the knob clockwise by approx. one graduation mark on the scale.
- Push the reset button (2b) in again.

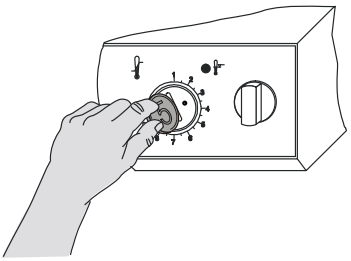


Figure 15: Setting the safety device class 2

	The unit is only active when the reset button (2b) is pushed in.

When the safety device responds, the red alarm lamp (2a) illuminates, the reset button (2b) pops out, and the oven is turned off permanently at all poles.

	Check the setting regularly and adjust it following changes of the set-point or charge.

Example:	A substance with an ignition temperature of 160 °C shall be dried. The maximum allowed drying temperature is 85 °C according to the information panel “Temperature setting” at the front of the unit (chap. 2.5). Set the temperature safety device to a temperature of 85 °C max. Also, the setting on the controller RD3 must not exceed this value.

According to IEC/CEI 60079-14 this unit is not designated for the temperature classes T4, T5, and T6. Introduce only substances with an ignition temperature which is higher than 135 °C / *275°F*.

This unit is not suitable to dry substances with an ignition temperature below 135 °C / *275°F*.

EX	**DANGER** **Explosion hazard.** **Danger of death.** ∅ Do NOT introduce any substance with an ignition temperature ≤135 °C / *275°F* into the oven.

13. Reference measurements. Checking the temperature in the inner chamber

The controller display was adjusted in the factory to the temperature in the center of the usable volume (chap. 19.1). The sensor probe of the reference measuring device was connected firmly to an expansion rack positioned in the middle of the unit.

Checking the controller display

- Conduct the reference sensor into the inner chamber through the measuring port (15). The port must be largely vacuum tight to enable a typical operation vacuum for the calibration. For a high vacuum, use a measuring access port. Usually, a silicone plug with a hole for the sensor wire is sufficient.
- Fix the sensor to the center of an expansion rack in the middle of the useable volume with adhesive aluminum tape or thermal conductive paste to ensure sufficient thermal conductivity.
- Perform the measurement in a thermally stable condition with 3 expansion racks and empty oven.
- Equilibrating time: at least 12 hours.

Checking the spatial temperature exactitude

- Fix at least 9 sensor probes on 3 racks with adhesive aluminum tape or thermal conductive paste to ensure sufficient thermal conductivity
- The distance of the sensor probes to all inner chamber walls must be at least 10% of the corresponding inner chamber dimension (see DIN 12880).
- Perform the measurement in a thermally stable condition with 3 expansion racks and empty oven.
- Response time: at least 12 hours.

	Do NOT use the temperature probe of the reference measurement device without any contact to the expansion rack, i.e., do NOT measure vacuum values!

	In case the temperature probe is a thermo element, mount it so it is electrically insulated from the rack.

If you note an excessive divergence between the controller and reference temperatures, please contact BINDER Service to calibrate the temperature controller.

14. Commissioning the vacuum

With regard to operation, please observe the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany).

Starting situation: The vacuum source is connected and ready for operation.

For the vacuum module with chemical membrane pump option, see chap. 15.3.

14.1 Evacuation

- Close the aeration valve (5) and the fine dosing valve for inert gas (6).
- Turn on the vacuum pump.
- Turn the lever of the vacuum shut off valve (8) to the “ON” position (valve open).
- Monitor the internal pressure on the pressure display (3). The analog manometer displays the running evaporation respectively the end of the drying procedure. The scale of the manometer (3) refers to an ideal ambient pressure of 1013 mbar / 29.9 *inHg*. Tolerance: 50 mbar / *37.5 mm Hg (Torr) / 1.5 inHg* (2.5% of the final scale value + reading precision). The optional digital pressure display (available via BINDER INDIVIDUAL customized solutions, chap. 15.4) offers an absolute scale.
- When the desired end vacuum is obtained, turn the VDL vacuum shutoff valve (8) to the “OFF” position (valve closed). The reached vacuum is now maintained.

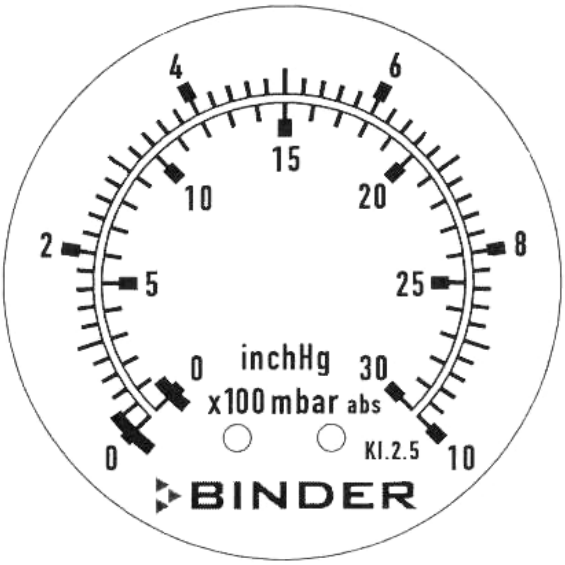


Figure 16: Manometer display

	The permissible end vacuum is 10^{-2} mbar / *0.0003 inHg*.

14.2 Breaking the vacuum (flooding)

When the drying procedure is complete, the vacuum in the inner container is broken (flooded).

- Open aeration valve (5) and fine dosing valve for inert gas (6)

Fresh air is introduced into the lower part of the rear panel of the inner chamber and is evenly distributed in the inner chamber. This supply of fresh air by under-flooding prevents turbulence of pulverized drying material.

14.3 Operation with inert gas

When operating the VDL safety vacuum drying oven with inert gas, correctly follow the technical ventilation measures, as described in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers’ liability insurance association) (for Germany).

During operation with inert gas, the unit is supplied with an oxygen displacing gas (e.g. N_2). Note: inert gas can be hazardous to health or even lethal, depending on its concentration in the respirable air. The gas emerging in the system must be diverted from the installation area by a suitable suction plant (see technical ventilation measures as described in the guideline BGI/GUV-I 850-0 on safe working in laboratories (formerly BGR/GUV-R 120 or ZH 1/119 laboratory guidelines issued by the employers’ liability insurance association) (for Germany). Correctly follow the maximum permitted workspace concentration of the inert gas used.

WARNING

Release of inert gas.

Danger of poisoning.

- Ensure technical ventilation measures.
- Correctly follow the maximum permitted workspace concentration of the inert gas used.
- When decommissioning the VDL safety vacuum drying oven, shut off the inert gas valve (6).

Install a pressure reducer for inert gas operation. Set the pressure reducer to a pressure slightly above ambient pressure. Ensure that the pressure reducer will open. Do not change this setting in order to avoid perturbation inside the oven and release of big quantities of inert gas after flooding the VDL.

Following evacuation, an inert gas, e.g., nitrogen, is led into the inner chamber via the fine dosing valve for inert gas (6), until pressure compensation with the atmosphere occurs. Depending on the individual application, you can perform a second evacuation and repeat the inert gas flooding.

When the inert gas fine dosing valve is open, a maximum of approx. 0.6 m³/h gas flows into the inner chamber. The introduction of inert gas by under-flooding in the lower region of the inner chamber rear wall and the extraction at the inner chamber ceiling allow an effective inert gas flushing.

15. Options

15.1 Connection kits VP4 and VP5 (option)

Connection kit VP4 (Art. no. 8012-0621) consists of:

- Straining ring DN10/16 (3 pc.)
- Universal centering ring DN10/16 (3 pc.)
- Transition piece, adapter DN 16-10/8 (2 pc.)
- Vacuum hose 10/8, 2 m / *78.7 in*
- Union nut M14 (2 pc.)
- Elbow DN 10/10

Connection kit VP5 (Art. no. 8012-0622) consists of:

- Straining ring DN 10/16 (2 pc.)
- Straining ring DN 20/25
- Universal centering ring DN 10/16 (2 pc.)
- Outer centering ring DN 20/25
- Transition piece, adapter DN 16-10/8
- Transition piece, adapter DN 25-DN10/8 with union nut M14
- Union nut M14
- Vacuum hose 10/8, 2 m / *78.7 in*
- Elbow DN 10/10

For mounting the VDL connection kits VP4 and VP5, please refer to the mounting instructions Art. no. 7001-0152 supplied with each connection kit.

15.2 Vacuum module empty (without pump) (option)

	The mounting instructions Art. no. 7001-0137 supplied with the vacuum module describe how to mount the VDL safety vacuum drying oven onto the vacuum module and installing the suction line to the vacuum module.

Connection to a vacuum source

Connect the vacuum connection (13) (small flange DN 16) at the rear of the unit at the top to a vacuum pump or to a domestic vacuum system via a vacuum hose or a fixed vacuum pipe.

When using a vacuum hose, we recommend using the BINDER connection kits VP4 or VP5 (chap. 15.1). The module has an appropriate hose outlet at the back.

Figure 17: VDL 53 with the option “Vacuum module”, mounted, and installed vacuum hose

	CAUTION
	Technical defects due to excessive negative pressure. **Danger of implosion.** **Damage to the unit.** ∅ The end vacuum must NOT fall below the permissible level of 10^{-2} mbar / *0.0003 inHg*. ➢ Install the pump according to the permissible end vacuum or limit the end vacuum via a vacuum controller.

	Avoid the solvent accumulation in the vacuum module (option) as this would cause the vacuum module to become an explosive area (Zone 0 or 1 or 2). The VDL safety vacuum drying oven located on top of the module is not explosion-proof constructed in regards to its surroundings.

Inappropriate execution of the pump connection can lead to the risk of explosion.

DANGER

Inappropriate pump connection.

Risk of ignition and explosion.

Danger of death.

- ➢ It is important to observe the pump manufacturer's instructions regarding correct connection and commissioning.
- ➢ Observe the safety advice of chap. 1.5.

Extracted vapors or the occasionally used inert gas can endanger health and/or have a corrosive effect on the oven and pump.

WARNING

Release of extracted vapors.

Danger of injury.

Damage to the oven and pump by corrosion.

- ➢ Remove the extracted vapors and, if appropriate, the inert gas from the module via a suitable conduit into e.g., a fume extractor facility.
- ➢ Directly connect the conduit to the corresponding pump outlets.

Confirm that the vacuum source is designed for a gas inlet temperature corresponding to the used drying temperature, or take appropriate measures to cool down the extracted vapor before its entry into the vacuum source.

A gas inlet temperature of 40 °C / *104°F* maximum must NOT be exceeded. If the gas inlet temperature is too high and then becomes even warmer by compression in the pump, the resulting temperature (of the gas-solvent mixture inside the pump) could exceed the solvent's temperature class and ignition temperature.

DANGER

Exceeding the gas inlet temperature.

Exceeding the ignition temperature of the solvent.

Risk of ignition and explosion.

Damage to the vacuum pump.

Danger of death.

- ∅ Do NOT exceed a set-point temperature of 40 °C / *104°F*.
- ➢ With set-point temperature > 40 °C / *104°F*, take appropriate measures to cool down the extracted vapor before its entry in the vacuum pump.

15.3 Vacuum module with chemical membrane pump (option)

	The mounting instructions Art. no. 7001-0137 supplied with the vacuum module describe how to mount the VDL safety vacuum drying oven onto the vacuum module and installing the suction line into the vacuum module.

The MZ2C EX or MD4C EX membrane pump is located in a separate transport packaging. Both pump types are delivered as complete pump stations with a separator and an exhaust waste vapor condenser.

Figure 18: VDL 53 with option vacuum module with pump

(13) Vacuum connection

	Avoid the solvent accumulation in the vacuum module (option) as this would cause the vacuum module to become an explosive area (Zone 0 or 1 or 2). The VDL safety vacuum drying oven located on top of the module is not explosion-proof constructed in regards to its surroundings.

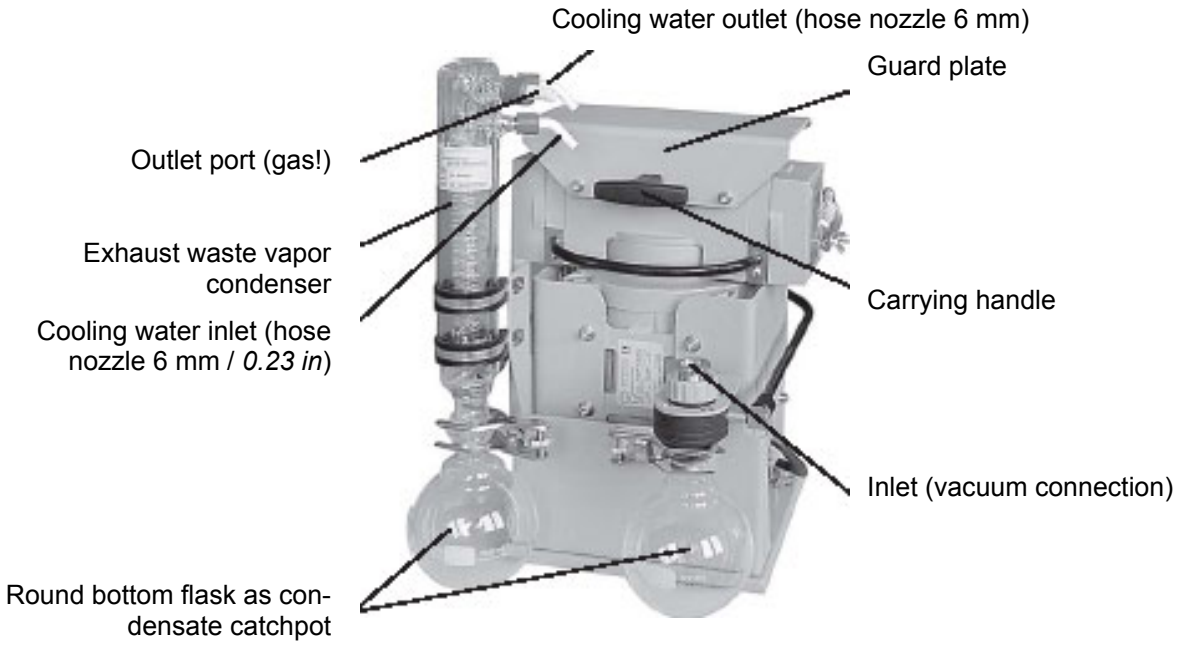

Cooling water outlet (hose nozzle 6 mm)
Guard plate
Outlet port (gas!)
Exhaust waste vapor condenser
Cooling water inlet (hose nozzle 6 mm / *0.23 in*)
Carrying handle
Inlet (vacuum connection)
Round bottom flask as condensate catchpot

Figure 19: Vacuum pump MZ2C EX

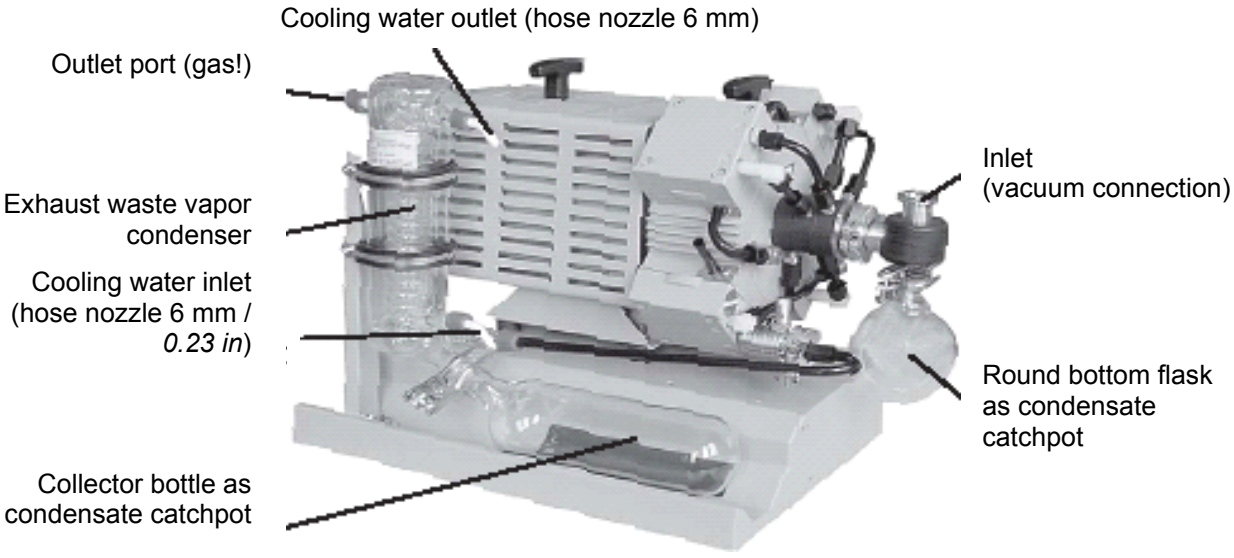

Cooling water outlet (hose nozzle 6 mm)
Outlet port (gas!)
Inlet (vacuum connection)
Exhaust waste vapor condenser
Cooling water inlet (hose nozzle 6 mm / *0.23 in*)
Round bottom flask as condensate catchpot
Collector bottle as condensate catchpot

Figure 20: Vacuum pump MZ4C EX

Defining the zone of the installation site of the vacuum pump (guideline 1999/92/EC)

If the pump module is defined as Zone 1, the operating chamber of the vacuum pump must be swept with inert gas. A flow of at least 1 liter per minute (without pressure) is needed. For Zone 2 or without any zone sweeping with inert gas is not needed. In addition to sweeping with inert gas, in case of condensing media, you can connect a gas ballast in order to avoid condensation.

Installation of the supplied vacuum pump

- The safety vacuum drying oven is mounted onto the vacuum module as described in the mounting instructions Art. no. 7001-0137.
- The suction line is installed to the vacuum module as described in the mounting instructions Art. no. 7001-0137.
- When the pump is removed from the original packaging, place it in the vacuum module.
- Connect the pre-installed suction line to the vacuum pump inlet at the suction-side small flange connection located at the top of the condensate flask.
- Connect a conduit that is suitable for removing the extracted vapors from the module, onto the pressure-side connection of the vacuum pump (hose olive on the top-back of the emission condenser).
- Guide the end of the conduit into an exhaust air system, which is explosion-proof constructed in consideration of any possible residual solvent contents. The operator must check if an explosive atmosphere may be present at the pump exit or at the exhaust waste vapor condenser. For this purpose, use a calculation of the solvent's partial pressure at the set-up coolant temperature of the exhaust waste vapor condenser and compare it to the explosion limits of the pumped solvent. The exhaust solvent concentration should be minimized by selecting the most appropriate condensation temperature for the solvent at the refrigeration plant that can be connected to the exhaust waste vapor condenser. The pumped-out gases at the pump exit or the exhaust waste vapor condenser must be removed in a controlled manner and according to applicable security regulations. If there is any possibility that an explosive mixture could still exist, the exhaust must be removed through antistatic conduits and disposed of according to the valid regulations of explosion protection.
- The electrical connection is established at the pump's connector box. This must be carried out according to the original user manual of the pump manufacturer and to EN 60079-14. In addition, the zone that has been defined by the user for the installation site of the pump must be correctly observed. Equipotential bonding between the pump housing and the housing of the VDL safety vacuum drying oven must be assured by the connected equipment grounding conductors of both units.

Inappropriate execution of the pump connection can lead to the risk of explosion.

DANGER

Inappropriate pump connection.

Risk of ignition and explosion.

Danger of death.

- ➢ It is obligatory to follow the instructions of the pump manufacturer regarding correct connection and commissioning.
- ➢ Observe the safety advice as in chap. 1.5.

Extracted vapors or the occasionally used inert gas can endanger health. They can also have a corrosive effect on the oven and pump.

WARNING

Release of extracted vapors.

Danger of injury.

Damage to oven and pump by corrosion.

- ➢ Remove the extracted vapors and, if appropriate, the inert gas from the module via a suitable conduit into e.g., a fume extractor facility.
- ➢ Directly connect the conduit to the corresponding pump outlets.

You can connect a laboratory cooling system to the emission condenser of the vacuum pumps MZ2C EX or MD4C EX.

For operating the chemical membrane pumps MZ2C EX and MD4C EX, please refer to the enclosed pump manufacturer's operating manual.

Confirm that the vacuum source is designed for a gas inlet temperature corresponding to the used drying temperature, or take appropriate measures to cool down the extracted vapor before its entry into the vacuum source.

The ATEX (Directive 94/9/EG) compliant vacuum pumps offered by BINDER are designed for a gas inlet temperature of 40 °C / *104°F* max. Do NOT exceed this temperature. If the gas inlet temperature is too high and then becomes even warmer by compression in the pump, the resulting temperature (of the gas-solvent mixture inside the pump) could exceed the solvent's temperature class and ignition temperature.

DANGER

Exceeding the gas inlet temperature.

Exceeding the ignition temperature of the solvent.

Risk of ignition and explosion.

Damage to the vacuum pump.

Danger of death.

- ∅ Do NOT exceed a set-point temperature of 40 °C / *104°F*.
- ➢ With set-point temperature > 40 °C / *104°F*, take appropriate measures to cool down the extracted vapor before its entry into the vacuum pump.

The maximum permissible ambient temperature of the vacuum pumps delivered by BINDER is 40 °C / *104°F*.

15.4 Digital pressure display (available via BINDER INDIVIDUAL customized solutions)

With this option, a digital display indicates the internal pressure with the accuracy of 1 mbar / *0.03 inHg*. The pressure is measured by a permanently fitted internal ex-proof pressure sensor.

A service engineer can calibrate and internally adjust the digital pressure display.

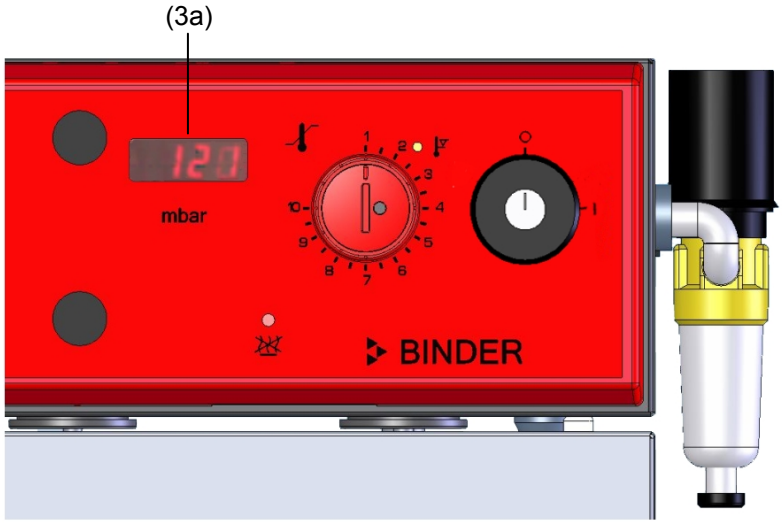


Figure 21: Digital display of internal pressure

The digital display (3a) for pressure in the usable volume shows the actual measuring value immediately after putting the unit into operation.

15.5 Additional measuring channel for digital object temperature display with flexible Pt 100 temperature sensor (option)

The object temperature display permits recording the object temperature directly on or in the drying material. The object temperature is measured via a flexible Pt100 sensor inside the inner chamber. The sensor needs to be in thermally conducting contact with the charging material. It can be plunged into humid charging material up to the length of its protecting tube.

The object temperature is indicated on Display 2 of the RD3 controller.

Display 1 shows	e.g. 24.6 °C	(actual temperature value)
Display 2 shows	24.4 15:41	(actual object temperature in °C, actual time)

Figure 22:
Standard Display without the
object temperature display option

Figure 23:
Display with the
object temperature display option

The object temperature data is put out combined with the temperature data of the controller to the RS 422 interface as a second measuring channel. This permits recording by the BINDER documentation software APT-COM™ DataControlSystem (option, chap. 15.7).

Assembly and connection of the object temperature recording

- Insert the Pt 100 temperature sensor from the rear through the measuring connection (15) into the inner chamber.
- The 3 contacts of the Pt 100 sensor are conducted outside via a measuring access port. From there, establish the connection to the DIN socket (14) at the top of the rear panel of the unit marked “Pt100”. For reasons of explosion protection, this electrical connection to the inner chamber is conducted via a triple internal safety barrier with a conducting-state voltage of 1.6 Volt maximum against ground.

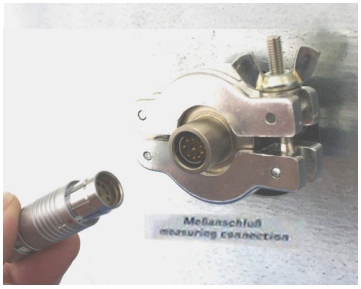


Figure 24:

Measuring connection (15) with measuring access port

Plug for connection cable to DIN socket “Pt 100”

Figure 25:

Measuring current port with universal eccentric ring and locking ring DN 16, with flexible Pt 100 temperature sensor

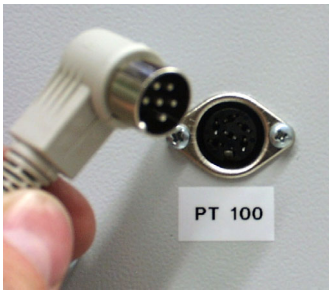


Figure 26:

Pt100 connection (14) at the rear of the unit

Technical data of the Pt 100 sensor:

- Three-wire technique
- Class B (EN 60751)
- Temperature range up to 300 °C / *572°F*
- Stainless steel protective tube, length 45 mm / *1.77 in*, stainless steel material no. 1.4501

	If the oven is charged to full capacity, depending on the load, deviations from the specified heating up times may occur.

15.6 Measuring access port vacuum 9 poles (option)

The measuring access port allows creating electrical connections for low voltages or sensors between the exterior and interior of the VDL safety vacuum drying oven. A 9 poles plug for the outside is included.

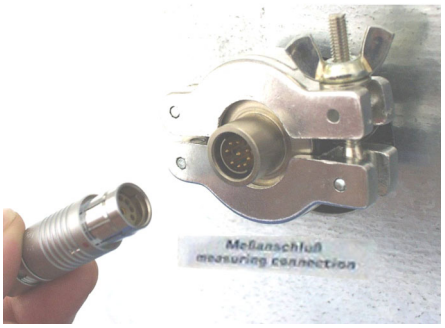


Figure 27: Measuring connection (15) with measuring access port and supplied plug

Connections at the measuring access port

- At the inner side of the measuring access port you can solder up to 9 cables. The inside connections must be insulated against each other and against ground. Use 300 °C / *572°F* solder.
- The 9 contacts are conducted outside via the measuring access port. You can use them to connect a device via the supplied plug.

Maximum load capacity of the switching contacts: 42 V AC/DC - 2A

DANGER

Electrical hazard.

Danger of death.

Damage to switching contacts and connection socket.

∅ Do NOT exceed the maximum switching load of 42 AC/DC – 2 Amp.

∅ Do NOT connect any devices with a higher load capacity.

➢ Insulate the inside connections against each other and against ground. Use 300 °C / *572°F* solder.

15.7 Communication software APT-COM™ 3 DataControlSystem (option)

The unit is regularly equipped with a serial interface RS 422 (9) that can connect the BINDER communication software APT-COM™ 3 DataControlSystem. The actual temperature value is given at adjustable intervals. Programming can be performed graphically via PC. Up to 30 chambers with RS 422 interface can be cross-linked. For further information, refer to the operating manual of the BINDER communication software APT-COM™ 3.

Confirm that the interface mode is correctly set to “Modbus” in the user level (chap. 10).

Pin allocation of the RS 422 interface (9):

pin 2: RxD (+)
pin 3: TxD (+)
pin 4: RxD (-)
pin 5: TxD (-)
pin 7: GND

15.8 Protocol printer (option)

Connect the protocol printer using the VDL interface RS 422 (9) via an interface converter RS422 / RS232.

Make sure that the interface mode is correctly set to “Printer” in the user level (chap. 10).

The actual temperature values are put out regularly with fixed formatting.

See “Manual for Setting Matrix Printer Epson LX-300+“, Art. No. 7001-0041.

Printout: one printed line for each print interval with relative time stamp, temperature value with one decimal point, curve representation. In every 5th line the set print interval “Ptime” in minutes is noted. The printer interval is set in the user level (chap. 10).

Figure 28: Protocol printer

Example:

```
Temp.: 34.7                    *
Temp.:  35.6                     *
Temp.:  32.8                   *
Temp.:  30.1                   *
Ptime : 001.                   *
Temp.:  27.4                 *
Temp.:  26.9                 *
Temp.:  26.6                 *
Temp.:  26.4                 *
Ptime : 001.                 *
Temp.:  26.2                 *
```

In this example the print interval is set to 1 min, i.e., every minute a new temperature value is printed.

	In conjunction with the specified print interval, real-time reference can be achieved by noting down the starting time of recording.

Interface configuration:	Baud rate:	9600
	Stop bit:	1
	Parity:	none

16. Maintenance, cleaning, and service

16.1 Maintenance intervals, service

DANGER

Electrical hazard.

Danger of death.

∅ The unit must NOT become wet during operation or maintenance work.

∅ Do NOT remove the rear panel of the unit.

➢ Disconnect the unit before conducting maintenance work. Disconnect the power plug.

➢ Ensure all maintenance work is conducted by licensed electricians or experts authorized by BINDER.

Ensure regular maintenance work is performed at least once a year.

	The warranty becomes void if maintenance work is conducted by non-authorized personnel.

	Replace the door gasket only when cold. Otherwise, the door gasket may become damaged.

We recommend taking out a maintenance agreement. Please consult BINDER Service:

BINDER telephone hotline:	+49 (0) 7462 2005 555
BINDER fax hotline:	+49 (0) 7462 2005 93555
BINDER e-mail hotline:	service@binder-world.com
BINDER service hotline USA:	+1 866 885 9794 or +1 631 224 4340 (toll-free in the USA)
BINDER service hotline Spain	+34 9492 677 23
BINDER service hotline Asia Pacific:	+852 39070500 or +852 39070503
BINDER service hotline Russia and CIS	+7 495 98815 17
BINDER Internet website	http://www.binder-world.com
BINDER address	BINDER GmbH, post office box 102, D-78502 Tuttlingen

International customers, please contact your local BINDER distributor.

The condensate separator is equipped with a manual condensate outlet. When condensate has accumulated in the condensate separator, you can let it off by opening the discharging screw at the bottom. With connected supply pressure for sweeping the area for electrical equipment, condensate may spout.

CAUTION

Opening the discharging screw with connected supply pressure for sweeping the area for electrical equipment.

Danger by spouting condensate.

➢ Wear eye protectors when the supply pressure for sweeping the area for electrical equipment is connected.

16.2 Cleaning and decontamination

DANGER

Electrical hazard.

Danger of death.

∅ Do NOT spill water or cleaning agents over the inner and outer surfaces.

➢ Disconnect the unit before cleaning. Disconnect the power plug.

➢ Completely dry the appliance before turning it on again.

Cleaning

Disconnect the oven from the power supply before cleaning. Disconnect the power plug.

Wipe the surfaces with a moistened towel. In addition, you can use the following cleaning agents:

Exterior surfaces, inner chamber, door gaskets	Standard commercial cleaning detergents free from acid or halogenides. Alcohol-based solutions. We recommend using the neutral cleaning agent Art. No. 1002-0016.
Expansion racks, rack holders	Standard commercial cleaning detergents free from acid or halogenides, no salt solution or chlorinated solvents. We recommend using the neutral cleaning agent Art. No. 1002-0016.
Instrument panel	Standard commercial cleaning detergents free from acid or halogenides. We recommend using the neutral cleaning agent Art. No. 1002-0016.
Filter of compressed air supply	If necessary, use compressed air

	For surface protection, perform cleaning as quickly as possible. After cleaning completely remove cleaning agents from the surfaces with a moistened towel.

	CAUTION **Danger of corrosion.** **Damage to the unit.** ∅ Do NOT use cleaning detergents with acids or halogenides.

	We recommend using the neutral cleaning agent Art. No. 1002-0016 for a thorough and mild cleaning. Any corrosive damage that may arise following use of other cleaning agents is excluded from liability by BINDER GmbH.

Decontamination

Safety vacuum drying ovens VDL can be hot air sterilized at 190 °C / *374°F* for at least 30 minutes. Remove any inflammable goods from the interior before.

	With every decontamination method, always use adequate personal safety controls.

16.3 Sending the unit back to BINDER GmbH

If you return a BINDER product to us for repair or any other reason, we will only accept the product upon presentation of an authorization number that has previously been issued to you. An authorization number will be issued after receiving your complaint either in writing or by telephone **prior** to your sending the BINDER product back to us. The authorization number will be issued following receipt of the information below:

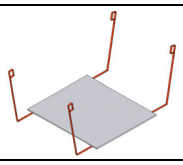
- BINDER product type and serial number
- Date of purchase
- Name and address of the dealer from which you bought the BINDER product
- Exact description of the defect or fault
- Complete address, contact person and availability of that person
- Exact location of the BINDER product in your facility
- A contamination clearance certificate (chap. 20) must be faxed in advance

The authorization number must be applied to the packaging in such a way that it can be easily recognized or be recorded clearly in the delivery documents.

	For security reasons we cannot accept a unit delivery if it does not carry an authorization number.

17. Disposal

17.1 Disposal of the transport packing

Packing element	Material	Disposal
Straps to fix packing on pallet	Plastic	Plastic recycling
Wooden transport box (option)	Non-wood (compressed match-wood, IPPC standard)	Wood recycling
with metal screws	Metal	Metal recycling
Pallet with foamed plastic stuffing	Solid wood (IPPC standard)	Wood recycling
	PE foam	Plastic recycling
Transport box with metal clamps	Cardboard	Paper recycling
	Metal	Metal recycling
Removal aid 	Cardboard	Paper recycling
	Plastic	Plastic recycling
Edge protection	Styropor® or PE foam	Plastic recycling
Protection of doors	PE foam	Plastic recycling
Bag for operating manual	PE foil	Plastic recycling
Insulating air cushion foil (packing of optional accessories)	PE foil	Plastic recycling

If recycling is not possible, all packing parts can also be disposed of with normal waste.

17.2 Decommissioning

- Turn off the key switch (1) (position 0).

	When turning off the key switch (1), the stored parameters remain saved.

- Close the fine dosing valve (6) for inert gas supply.

  Through the open inert gas connection, inert gas can enter the safety vacuum drying oven and escape into the ambient air.

	WARNING **Release of inert gas.** **Danger of poisoning.** ➢ When decommissioning the VDL safety vacuum drying oven, turn off the inert gas supply at the inert gas valve (6).

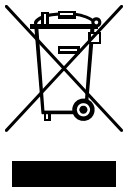
- Turn off the vacuum pump. Break the vacuum as described in chap. 14.2
- Disconnect the oven from the power supply. Pull the power plug.
- Remove the vacuum connection (chap. 4.3).
- Remove the inert gas connection and the pressure reducer (chap. 4.4).

Temporal decommissioning: See indications for appropriate storage, chap. 3.3.

Final decommissioning: Dispose of the unit as described in chap. 17.3 to 17.5.

17.3 Disposal of the unit in the Federal Republic of Germany

According to directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE), BINDER devices are classified as “monitoring and control instruments” (category 9) only intended for professional use“. They must not be disposed of at public collecting points.



The safety vacuum drying oven VDL bears the symbol for the marking of electrical and electronic equipment manufactured / placed on the market in the EC after 13 August 2005 and be disposed of in separate collection according to the directive 2002/96/EC on waste electrical and electronic equipment (WEEE) and German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG). WEEE marking: crossed-out wheeled bin with solid bar under. A significant part of the materials must be recycled in order to protect the environment.

At the end of the device’s service life, have the device disposed of according to the German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG) from 23 March 2005, BGBl. I p. 762 or contact BINDER Service who will organize taking back and disposal of the unit according to the German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG) from 23 March 2005, BGBl. I p. 762.

CAUTION

Violation against existing law.

∅ Do NOT dispose of BINDER devices at public collecting points.

➢ Have the device disposed of professionally at a recycling company which is certified according to the German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG) from 23 March 2005, BGBl. I p. 762.

or

➢ Instruct BINDER Service to dispose of the device. The general terms of payment and delivery of BINDER GmbH apply, which were valid at the time of purchasing the unit.

Certified companies disassemble waste BINDER equipment in primary substances for recycling according to directive 2002/96/EC. The devices must be free from toxic, infectious or radioactive substances in order to eliminate any health hazards to the employees of the recycling companies.

Prior to handing the unit over to a recycling company, it is the user’s responsibility that it is free from toxic, infectious or radioactive substances.

- Prior to disposal, clean all introduced or residual toxic substances from the unit.
- Prior to disposal, disinfect the unit from all sources of infection. Be aware that sources of infection may also be located outside the inner chamber.
- If you cannot safely remove all toxic substances and sources of infection from the unit, dispose of it as “special” waste according to national law.
- Fill out the contamination clearance certificate (chap. 20) and enclose it with the unit.

WARNING

Contamination of the device with toxic, infectious or radioactive substances.

Danger of intoxication.

Danger of infection.

∅ NEVER take a unit contaminated with toxic substances or sources of infection for recycling according to directive 2002/96/EC.

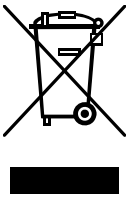
➢ Prior to disposal, remove all toxic substances and sources of infection from the unit.

➢ Dispose of a unit from which all toxic substances or sources of infection cannot be safely removed as “special” waste according to national law.

17.4 Disposal of the unit in the member states of the EC except for the Federal Republic of Germany

According to directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE), BINDER devices are classified as “monitoring and control instruments” (category 9) only intended for professional use“. They must not be disposed of at public collecting points.

The safety vacuum drying oven VDL bears the symbol for the marking of electrical and electronic equipment manufactured / placed on the market in the EC after 13 August 2005 and be disposed of in separate collection according to the directive 2002/96/EC on waste electrical and electronic equipment (WEEE). WEEE marking: crossed-out wheeled bin with solid bar under.



At the end of the device’s service life, notify the distributor who sold you the device, who will take back and dispose of the unit according to the directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment (WEEE).

CAUTION

Violation against existing law.

∅ Do NOT dispose of BINDER devices at public collecting points.

➢ Have the device disposed of professionally at a recycling company that is certified according to conversion of the directive 2002/96/EC into national law.

or

➢ Instruct the distributor who sold you the device to dispose of it. The agreements apply that were agreed with the distributor when purchasing the unit (e.g. his general terms of payment and delivery).

➢ If your distributor is not able to take back and dispose of the unit, please contact BINDER service.

Certified companies disassemble waste BINDER equipment in primary substances for recycling according to directive 2002/96/EC by. The devices must be free from toxic, infectious or radioactive substances in order to eliminate any health hazards to the employees of the recycling companies.

Prior to handing the unit over to a recycling company, it is the user's responsibility that it is free from toxic, infectious or radioactive substances.

- Prior to disposal, clean all introduced or residual toxic substances from the unit.
- Prior to disposal, disinfect the unit from all sources of infection. Be aware that sources of infection may also be located outside the inner chamber.
- If you cannot safely remove all sources of infection and toxic substances from the unit, dispose of it as "special" waste according to national law.
- Fill out the contamination clearance certificate (chap. 20) and enclose it with the unit.

WARNING

Contamination of the device with toxic, infectious or radioactive substances.

Danger of intoxication.

Danger of infection.

∅ NEVER take a unit contaminated with toxic substances or sources of infection for recycling according to directive 2002/96/EC.

➢ Prior to disposal, remove all toxic substances and sources of infection from the unit.

➢ Dispose of a unit from which all toxic substances or sources of infection cannot be safely removed as "special" waste according to national law.

17.5 Disposal of the unit in non-member states of the EC

CAUTION

Alteration of the environment.

➢ For final decommissioning and disposal of the safety vacuum drying oven, please contact BINDER Service.

➢ Follow the statutory regulations for appropriate, environmentally friendly disposal.

The main board of the safety vacuum drying oven includes a lithium cell. Please dispose of it according to national regulations.

18. Troubleshooting

Fault description	Possible cause	Required measures
General		
Unit permanently turned off.	No power supply.	Check connection to power supply.
	Wrong voltage.	Check power supply for voltage of 115V or 230V.
	Oven not connected to compressed air supply.	Connect the oven to the compressed air supply before start-up.
	Unit fuse has responded.	Check unit fuse.
	Safety device has turned off the oven.	Allow the oven to cool down and press the “RESET” button. Check temperature set-point and setting of safety device (chap. 12). If appropriate, select suitable limit value.
	Safety device defective.	Contact BINDER Service.
	Controller defective.	
Heating		
Chamber doesn’t heat up. LED (7a) “Heating active” lit. Pilot light (4) “No heating release” lit.	Pressure > 125 ± 25 mbar / *3.69 ±0.74 inHg*.	A vacuum of 125 ± 25 mbar / *3.69 ±0.74 inHg*.) or below is needed for heating release.
	Unit door not properly closed.	Completely close unit door.
	Door gasket defective.	Replace door gasket.
Chamber doesn’t heat up. LED (7a) “Heating active” lit. Pilot light (4) “No heating release” not lit.	Heating element defective.	Contact BINDER Service.
	Semiconductor relay defective.	
Chamber doesn’t heat up. LED (7a) “Heating active” not lit.	Safety device has turned off the oven.	Allow the oven to cool down and press down the “RESET” button. Check temperature set-point and setting of safety device (chap. 12). If appropriate, select suitable limit value.
	Controller defective	Contact BINDER Service
Set-point temperature is not reached after specified time.	Controller not adjusted.	Calibrate and adjust controller.
Chamber heating permanently, set-point not held.	Controller defective.	Contact BINDER Service.
	Pt 100 sensor defective.	
	Semiconductor relay defective	
	Controller not adjusted.	Calibrate and adjust controller.
Deviations from the indicated heating-up times.	Oven fully loaded.	Charge the oven less or consider longer heating-up times.
Deviations from the temperature set-point in equilibrated state.	Invalid calibration	Use the delivered expansion racks only. Do NOT change between aluminum and stainless steel racks
Wrong temperature value measured during calibration.	Reference temperature sensor has insufficient contact to expansion rack.	Fix the reference temperature sensor with thermal conductive paste or adhesive aluminum tape.
	Leakage current when using a thermo element not electrically insulated	Mount a thermo element electrically insulated from the rack.

Fault description	Possible cause	Required measures
Vacuum		
Vacuum not held.	Door gasket defective.	Replace door gasket,
	Safety glass panel defective.	Replace safety glass panel.
	Gaskets of small flange connections (universal eccentric ring) defective.	Replace gaskets of small flange connections.
	Inner tube connection leaky.	Contact BINDER Service.
Controller		
No indication on the controller display after turning on the oven.	Oven not connected to compressed air supply.	Connect the oven to the compressed air supply before start-up.
Program doesn't run correctly after it is started.	Pressure > 125 ± 25 mbar / *3.69 ±0.74 inHg*).	A vacuum of 125 ± 25 mbar / *3.69 ±0.74 inHg*) or below is needed for heating release. Only then start the program.
Program duration longer than programmed.	Inappropriate tolerances have been programmed.	For rapid transition phases, do NOT program tolerance limits in order to permit maximum heating speed.
Program stops one section too early.	Program line is incomplete.	When programming, define the end value of the desired cycle by adding an additional section with a section time of at least one minute (with setting "ramp").
Programs have been deleted.	Change from 2 programs to 1 program or vice-versa	When changing, ensure that the programs are no longer needed.
The controller returns to Normal Display from any level.	No button was pressed for more than 120 sec.	Repeat entries, enter the values rapidly.
Message RANGE ERROR CH1 in Normal Display in Display 2	Sensor rupture between sensor and controller	Contact BINDER Service.
Ramp temperature transitions are only realized as steps.	Set-point programming type set to "Step" in the User level (chap. 10).	Set the set-point programming type to setting "Ramp" in the User level (chap. 10).

	Only qualified service personnel authorized by BINDER must perform repair. Repaired units must comply with the BINDER quality standards.

19. Technical description

19.1 Factory calibration and adjustment

This unit was calibrated and adjusted in the factory. Calibration and adjustment were performed using standardized test instructions, according to the QM DIN EN ISO 9001 system applied by BINDER (certified since December 1996 by TÜV CERT). All test equipment used is subject to the administration of measurement and test equipment that is also a constituent part of the BINDER QM DIN EN ISO 9001 systems. They are controlled and calibrated to a DKD-Standard at regular intervals.

Factory adjustment was done in the center of the usable volume and under vacuum conditions. The sensor is fixed in the middle of the expansion rack in a way ensuring good thermal conductivity (heat conduction). Measuring is performed in equilibrated state.

CAUTION

Invalid calibration.

∅ Do NOT change between aluminum and stainless steel racks.

➢ Use the delivered expansion racks only.

19.2 VDL technical data

Unit size			**23**	**53**	**115**
External dimensions					
Vacuum oven	Width	mm / *inch*	515 / *20.28*	634 / *24.96*	740 / *29.13*
	Height (incl. feet)	mm / *inch*	655 / 25.79	775 / 30.51	900 / 35.43
	Depth	mm / *inch*	500 / *19.69*	550 / *21.65*	670 / *26.38*
Vacuum module (option)	Width	mm / *inch*	515 / 20.28	634 / 24.96	740 / 29.13
	Height	mm / *inch*	624 / 24.57	624 / 24.57	622 / 24.49
	Depth	mm / *inch*	500 / 19.69	550 / 21.65	670 / 26.38
Vacuum oven with option vacuum module	Width	mm / *inch*	515 / 20.28	634 / 24.96	740 / 29.13
	Height	mm / *inch*	1279 / 50.35	1400 / 55.12	1522 / 59.92
	Depth	mm / *inch*	500 / 19.69	550 / 21.65	670 / 26.38
Plus door handle, connections (depth)		mm / *inch*	100 / *3.94*	100 / *3.94*	100 / *3.94*
Wall clearance at the back		mm / *inch*	100 / *3.94*	100 / *3.94*	100 / *3.94*
Wall clearance at the side		mm / *inch*	135 / *5.31*	135 / *5.31*	135 / *5.31*
Internal dimensions					
Width		mm / *inch*	285 / *11.22*	400 / *15.75*	506 / *19.92*
Height		mm / *inch*	285 / *11.22*	400 / *15.75*	506 / *19.92*
Depth		mm / *inch*	295 / *11.61*	340 / *13.38*	460 / *18.11*
Interior volume		l / *cu.ft.*	23 / *0.8*	53 / *1.9*	115 / *4.1*
Number of expansion racks (aluminum)		regular / max	2/4	2/5	2/6
Distance between the racks		mm / *inch*	53 / *2.09*	62 / *2.44*	68 / *2.68*
Usable space per rack (width x depth)		mm / *inch*	234 x 280 / *9.21 x 11.02*	349 x 320 / *13.74 x 12.60*	455 x 440 / *17.91 x 17.32*
Permissible load per rack		Kg / *lbs*	20 / *44*	20 / *44*	20 / *44*
Permissible total load		Kg / *lbs*	35 / *77*	45 / *99*	65 / *143*
Weight (empty)		Kg / *lbs*	63 / *139*	95 / *209*	153 / *337*

Unit size			23	53	115
Temperature data					
Temperature range approx. 15 °C / *27 °F* above room temperature up to		°C / *°F*	200 / *392*	200 / *392*	200 / *392*
Temperature fluctuation		± K	0.1	0.1	0.1
Temperature uniformity (variation) [1]	at 100 °C / *212°F*	± K	1.5	2	3,5
	at 200 °C / *392°F*	± K	3	4.5	9
Heating up time [1] [2]	to 100 °C / *212°F*	min	65	80	95
	to 200 °C / *392°F*	min	100	115	150
Max. temperature of inner chamber surfaces		°C / *°F*	320 / *608*	320 / *608*	320 / *608*
Vacuum data					
Vacuum connection with small flange		DN mm / *inch*	16 / *0.63*	16 / *0.63*	16 / *0.63*
Measuring access port with small flange		DN mm / *inch*	16 / *0.63*	16 / *0.63*	16 / *0.63*
Inert gas connection with flow-limiter Adapter with hose olive		∅ mm / *inch*	8 / *0.31*	8 / *0.31*	8 / *0.31*
Permitted end vacuum		mbar / *inHg*	$1x10^{-2}$ / *0.0003*	$1x10^{-2}$ / *0.0003*	$1x10^{-2}$ / *0.0003*
Leak rate		bar/h / *inHg /h*	$1x10^{-2}$ / *0.295*	$1x10^{-2}$ / *0.295*	$1x10^{-2}$ / *0.295*
Classification of the explosion proof inner chamber (according to ATEX Directive 94/9/EC)			Ex II 3 G	Ex II 3 G	Ex II 3 G
Electrical data					
IP protection type according to EN 60529			IP 54	IP 54	IP 54
Nominal voltage (±10%) 50/60 Hz		V	230	230	230
Nominal power		kW	0.80	1.20	1.90
Unit fuse 5 x 20 mm / 250V / middle-time-lag (M)		Amp	10	10	10
Power plug			shock proof plug		
Power plug vacuum module (option)			shock proof plug		
Energy consumption	at 100 °C / *212°F*	Wh/h	105	150	250
	at 200 °C / *392°F*	Wh/h	280	445	785
Over-voltage category acc. to IEC 61010-1			II	II	II
Pollution degree acc. to IEC 61010-1			2	2	2

Legend:

1) Values only in combination with aluminum racks

2) Time to reach 98% of the set point temperature

All technical data is specified for units with standard equipment at an ambient temperature of +25 °C / *77 °F* and a power supply voltage fluctuation of ±10. The temperature data is determined in accordance to BINDER factory standard following DIN 12880, observing the recommended wall clearances of 10% of the height, width and depth of the inner chamber.

All indications are average values, typical for units produced in series. We reserve the right to change technical specifications at any time.

19.3 Equipment and Options

	To operate the safety vacuum drying oven VDL, use only original BINDER accessories or accessories / components from third-party suppliers authorized by BINDER. The user is responsible for any risk arising from using unauthorized accessories.

Regular equipment
Microprocessor program controller RD3 with LED display
Safety device class 2 according to DIN 12880
RS 422 printer and communication interface with adjustable printing intervals
Fine-dosing aeration valve
Inert gas connection with fine-dosing valve
Analog pressure display (manometer) (not with option digital pressure display)
Pressure switch for heating release (at pressure < 125 ± 25 mbar / *3.69 ±0.74 inHg*)
Area for electrical equipment swept with compressed air or inert gas with monitoring of the minimum supply pressure
Measuring connection (DN 16), rear
Safety glass panel
Intelligent adaptation of the heating power by soft heating-up function (selectable on-off)

Options / accessories		
Expansion racks, aluminum or stainless steel 1.4571		
FKM door gasket (temperature resistant up to 200 °C / *392°F*)		
Additional measuring channel for digital object temperature display with flexible Pt 100 temperature sensor		
Digital pressure display (adjustable) with Ex proof pressure sensor (BINDER Individual)		
Communication software APT-COM™ for logging and display of temperature data and networking up to 30 units with PC		
Protocol printer for numeric and graphic temperature documentation		
Connection kits VP4 and VP5 with various small flange parts		
Measuring access port vacuum 9 poles		
Vacuum module with chemical membrane pump MZ2C EX with separator and emission condenser, ready for connection		
• Ready to connect: Suction power	m^3/h	1.9
• End vacuum	mbar / *inHg*	12 / *0.35*
• Electrical connection (50 Hz)	V	230 / 1 N~
Vacuum module with chemical membrane pump MD4C EX with separator and emission condenser, ready for connection		
• Ready to connect: Suction power	m^3/h	3.7
• End vacuum	mbar / *inHg*	3 / 0.09
• Electrical connection (50 Hz)	V	230 / 1 N~
Factory calibration certificate		
Extension to factory calibration certificate (additional value)		
Factory calibration certificate for digital object temperature display		
Factory calibration certificate for digital pressure display		
Extension to factory calibration certificate for digital pressure display (additional pressure)		
Qualification folder		
Evaporating dish with rim, small or large		
Stable table on wheels with castors and locking brakes		

19.4 Spare parts

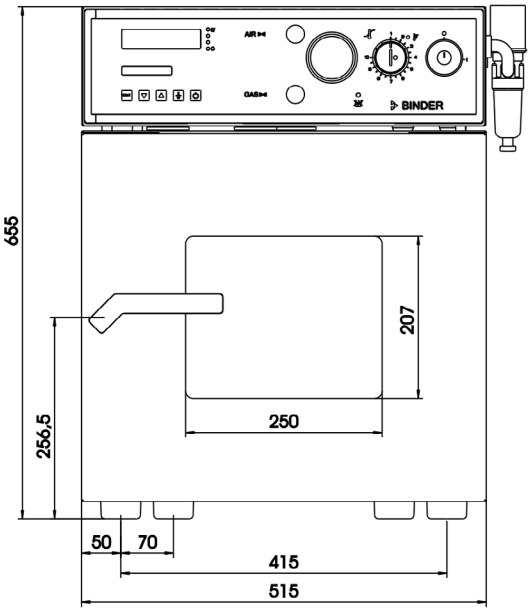
BINDER GmbH is responsible for the safety features of the unit only, provided skilled electricians or qualified personnel authorized by BINDER perform all maintenance and repair, and if components relating to chamber safety are replaced in the event of failure with original spare parts. The user is responsible for any risks arising from using unauthorized accessories/components.

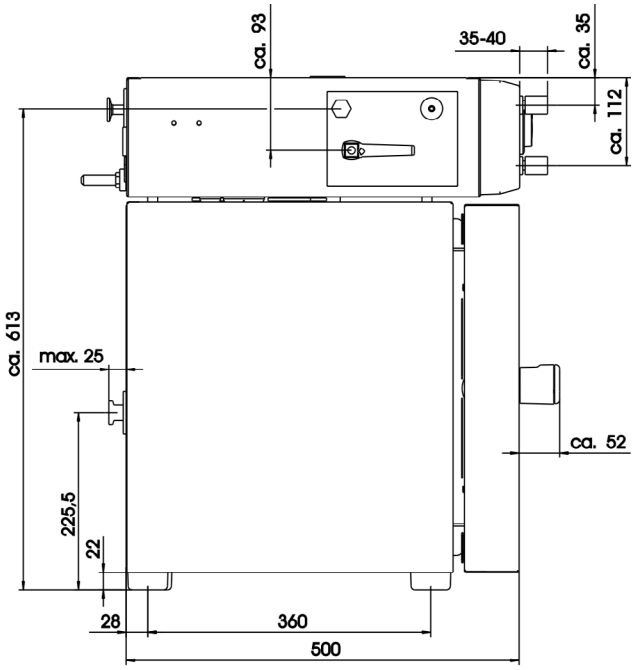
Accessories and spare parts:

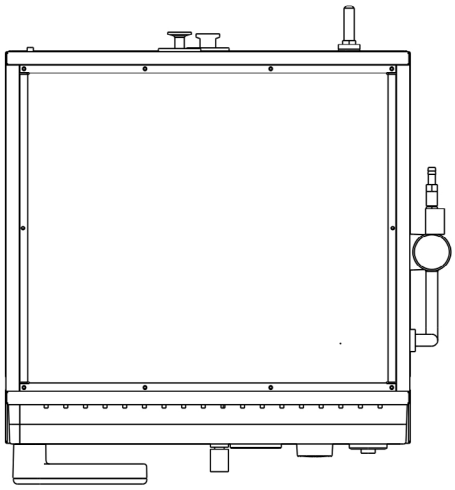
Unit size	**23**	**53**	**115**
Description	**Art. No.**		
Expansion rack aluminum	8009-0370	8009-0371	8009-0372
Expansion rack stainless steel	8009-0101	8009-0102	8009-0103
Door gasket silicon (temperature-resistant up to 200 °C / *392°F*)	6005-0015	6005-0016	6005-0018
Door gasket FKM (temperature-resistant up to 200 °C / *392°F*)	6005-0044	6005-0045	6005-0046
Unit fuse 5x20 mm / 250V / 10 Amp semi time lag (M)	5006-0012	5006-0012	5006-0012
Safety glass panel	6012-0007	6012-0008	6012-0015
Rack holder	4005-0071	4005-0072	4005-0073
Housing of instrument panel	6002-0067	6002-0016	6002-0016

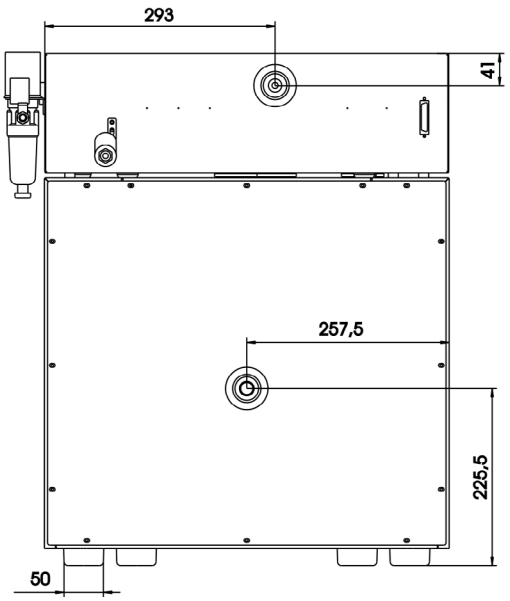
Shielding of instrument panel	6002-0017
Universal centering ring	6009-0048
Straining ring	6009-0009
Blind flange	6009-0010
Handle	6002-0002
Thermostat class 2 30° / *86°F* to 320 °C / *608°F*	5006-0008
Turning knob for thermostat class 2	8009-0004
Temperature sensor Pt 100	5002-0007
Temperature sensor Pt 100 heating	5002-0025
Protocol printer	8012-0418
2-channel pen recorder, external	8012-0153
Manometer	6013-0040
Program controller RD3	5014-0102
Power supply unit	5020-0026
Stable table on wheels with castors and locking brakes	9051-0018
Factory calibration certificate	8012-0031
Extension to factory calibration certificate (additional value)	8012-0044
Factory calibration certificate for digital object temperature display	8012-0442
Factory calibration certificate for digital pressure display	8012-0440
Extension to factory calibration certificate for digital pressure display (additional pressure)	8012-0441
Qualification folder	DL0090031
Evaporating dish, small	4022-0125
Evaporating dish, large	4022-0126
Neutral cleaning agent, 1 kg	1002-0016

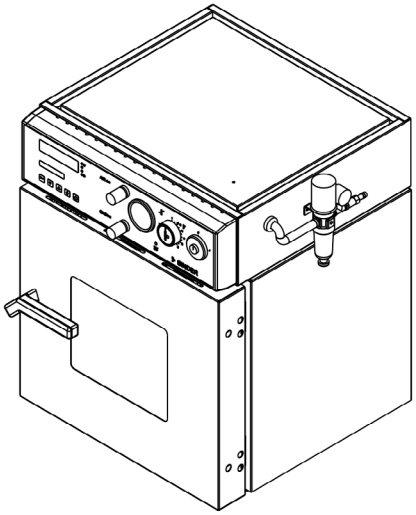
19.5 Dimensions VDL 23



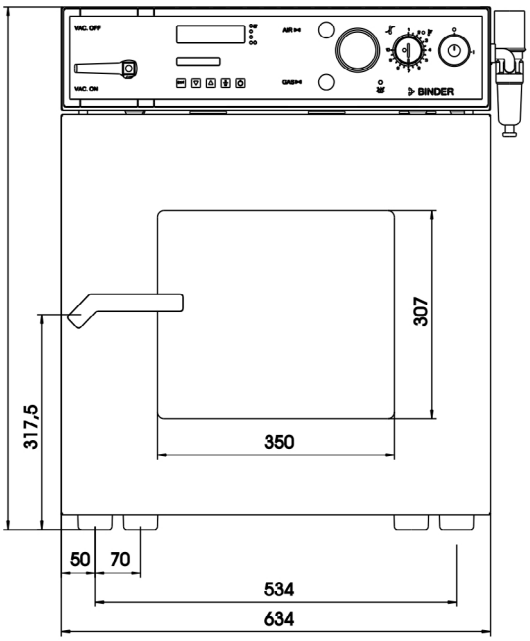


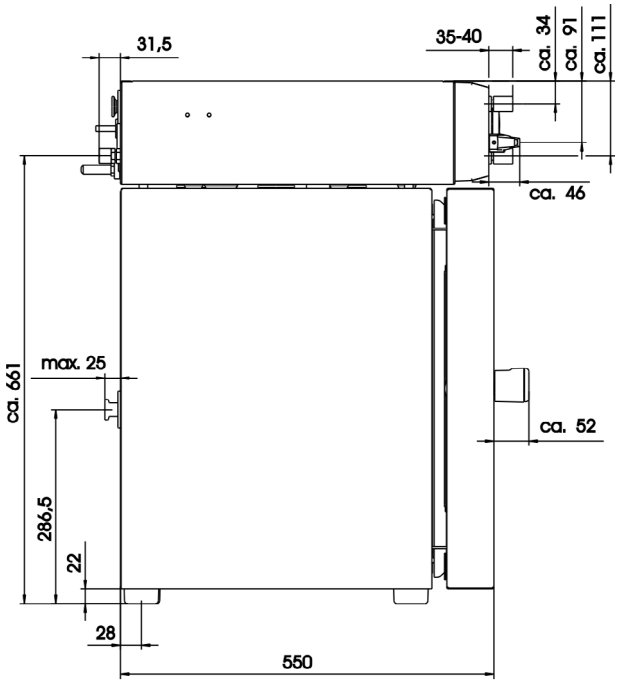


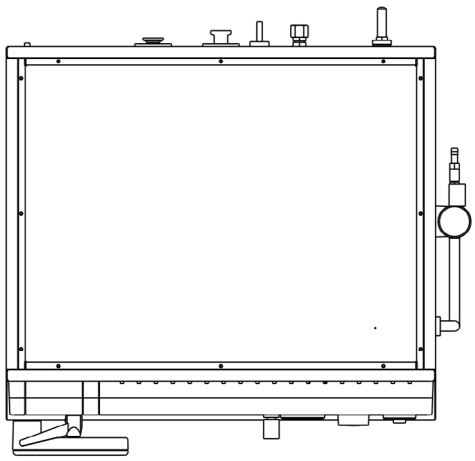


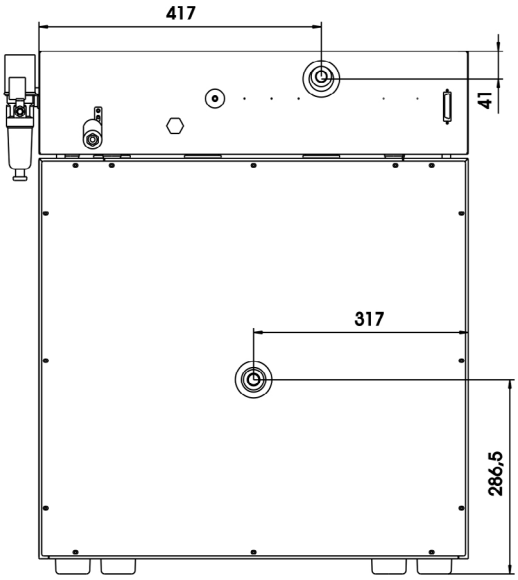


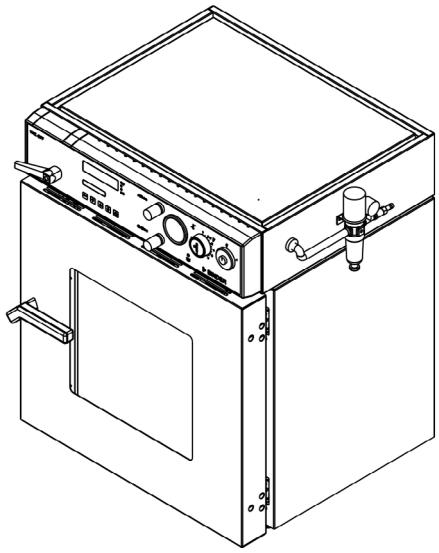
19.6 Dimensions VDL 53



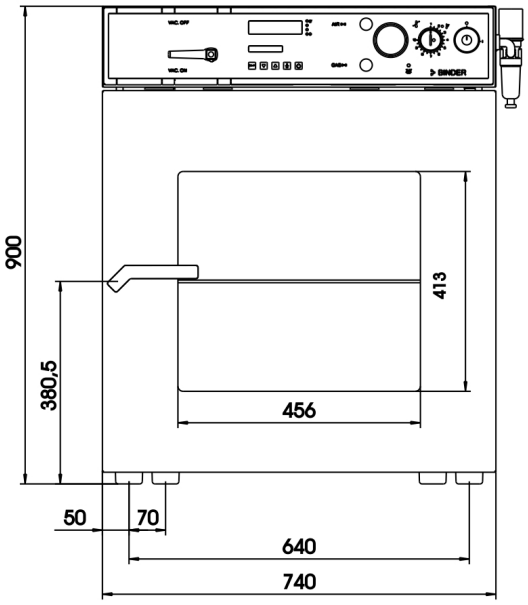


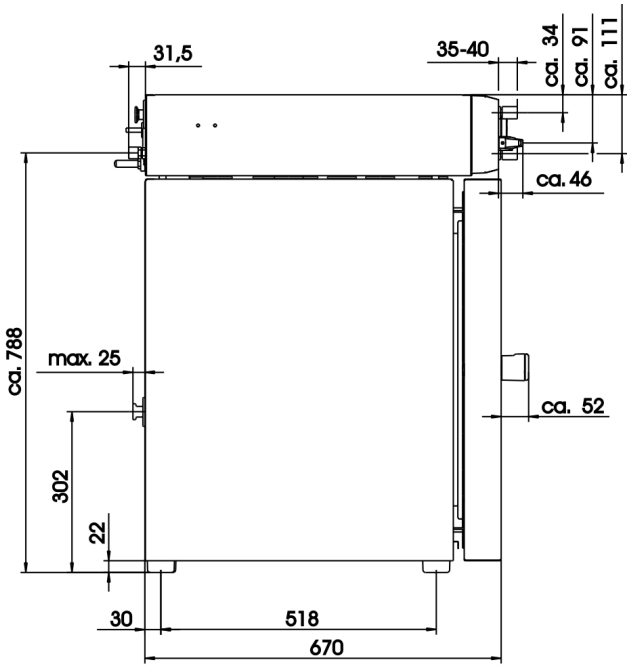


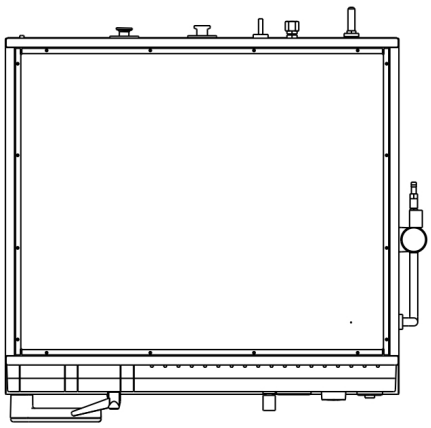


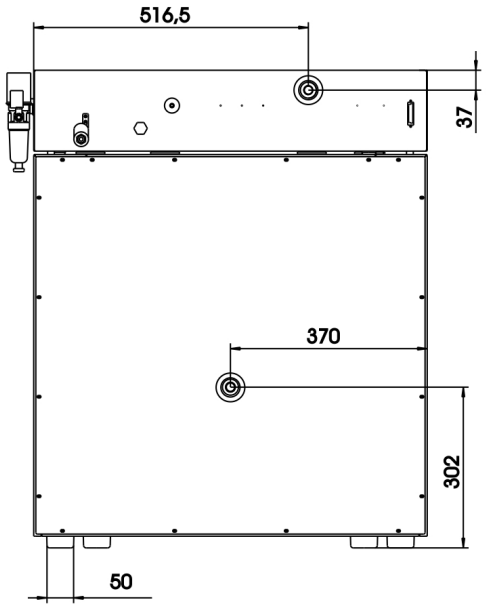


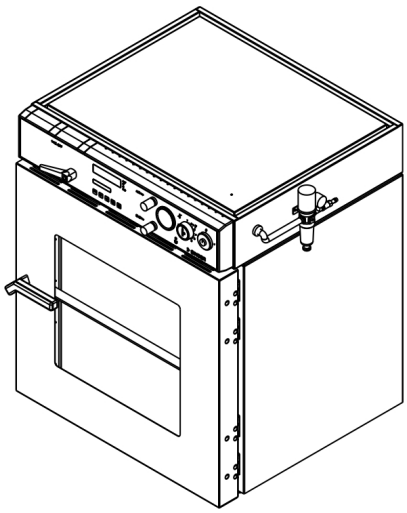
19.7 Dimensions VDL 115











20. Contamination clearance certificate

Unbedenklichkeitsbescheinigung

Declaration with regard to safety and health

Erklärung zur Sicherheit and gesundheitlichen Unbedenklichkeit

The German Ordinance on Hazardous Substances (GefStofV), and the regulations regarding safety at the workplace, require that this form be filled out for all products that are returned to us, so that the safety and health of our employees can be warranted.

Die Sicherheit und Gesundheit unserer Mitarbeiter, die Gefahrstoffverordnung GefStofV und die Vorschriften zur Sicherheit am Arbeitsplatz machen es erforderlich, dass dieses Formblatt für alle Produkte, die an uns zurückgeschickt wird.

	In the absence of a completely filled out form, repair is not possible. Ohne Vorliegen des vollständig ausgefüllten Formblattes ist eine Reparatur nicht möglich.

- A completely filled out form should be transmitted by Fax (+49 (0) 7462 2005 93555) or by letter in advance to us, so that this information is available before the equipment/component part arrives. A second copy of this form should accompany the equipment/component part. Eventually the carrier should be informed.

  Eine vollständig ausgefüllte Kopie dieses Formblattes soll per Telefax (Nr. +49 (0) 7462 2005 93555) oder Brief vorab an uns gesandt werden, so dass die Information vorliegt, bevor das Gerät/Bauteil eintrifft. Eine weitere Kopie soll dem Gerät/Bauteil beigefügt sein. Ggf. ist auch die Spedition zu informieren.

- Incomplete information or non-conformity with this procedure will inevitably lead to substantial delays in processing. We hope you will have understanding for this measure, which lies outside of our area of influence, and that you will help us to speed up this procedure.

  Unvollständige Angaben oder Nichteinhalten dieses Ablaufs führen zwangsläufig zu beträchtlichen Verzögerungen in der Abwicklung. Bitte haben Sie Verständnis für Maßnahmen, die außerhalb unserer Einflussmöglichkeiten liegen und helfen Sie mit, den Ablauf beschleunigen.

- **Please fill out this form completely.**

  Bitte unbedingt vollständig ausfüllen!

1.	**Unit/ component part / type:** / Gerät / Bauteil / Typ:
2.	**Serial No.** / Serien-Nr.:
3.	**Details about utilized substances / biological substances** / Einzelheiten über die eingesetzten Substanzen/biologische Materialien:
3.1	**Designations** / Bezeichnungen:
a)	_____
b)	_____
c)	_____
3.2	**Safety measures required for handling these substances** / Vorsichtsmaßnahmen beim Umgang mit diesen Stoffen:
a)	_____
b)	_____
c)	_____

3.3 **Measures to be taken in case of skin contact or release into the atmosphere** / Maßnahmen bei Personenkontakt oder Freisetzung:

a) _____

b) _____

c) _____

d) _____

3.4 **Other important information that must be taken into account** / Weitere zu beachtende und wichtige Informationen:

a) _____

b) _____

c) _____

4. **Declaration on the risk of these substances (please checkmark the applicable items)** / Erklärung zur Gefährlichkeit der Stoffe (bitte Zutreffendes ankreuzen) :

❑ **4.1** **For non toxic, non radioactive, biologically harmless materials** / für nicht giftige, nicht radioaktive, biologisch ungefährliche Stoffe:

We herewith guarantee that the above-mentioned unit / component part… / Wir versichern, dass o.g. Gerät/Bauteil...

❑ Has not been exposed to or contains any toxic or otherwise hazardous substances / weder giftige noch sonstige gefährliche Stoffe enthält oder solche anhaften.

❑ That eventually generated reaction products are non-toxic and also do not represent a hazard / auch evtl. entstandene Reaktionsprodukte weder giftig sind noch sonst eine Gefährdung darstellen.

❑ Eventual residues of hazardous substances have been removed / evtl. Rückstände von Gefahrstoffen entfernt wurden.

❑ **4.2** **For toxic, radioactive, biologically harmful or hazardous substances, or any other hazardous materials** / für giftige, radioaktive, biologisch bedenkliche bzw. gefährliche Stoffe oder anderweitig gefährliche Stoffe.

We herewith guarantee that … / Wir versichern, dass …

❑ The hazardous substances, which have come into contact with the above-mentioned equipment/component part, have been completely listed under item 3.1 and that all information in this regard is complete / die gefährlichen Stoffe, die mit dem o.g. Gerät/Bauteil in Kontakt kamen, in 3.1 aufgelistet sind und alle Angaben vollständig sind.

❑ That the unit /component part has not been in contact with radioactivity / das Gerät/Bauteil nicht mit Radioaktivität in Berührung kam

5. **Kind of transport / transporter /** Transportweg/Spediteur:

Transport by (means and name of transport company, etc.) Versendung durch (Name Spediteur o.ä.)

_____

Date of dispatch to BINDER GmbH / Tag der Absendung an BINDER GmbH:

_____

We herewith declare that the following measures have been taken / Wir erklären, dass folgende Maßnahmen getroffen wurden:

- ❑ Hazardous substances were removed from the unit / component part, so that no hazard exists for corresponding persons in the handling or repair of these items / das Gerät/Bauteil wurde von Gefahrstoffen befreit, so dass bei Handhabung/Reparaturen für die betreffenden Person keinerlei Gefährdung besteht
- ❑ The unit was securely packaged and properly identified / das Gerät wurde sicher verpackt und vollständig gekennzeichnet.
- ❑ Information about the hazardousness of the shipment (if required) has been provided to the transporter / der Spediteur wurde (falls vorgeschrieben) über die Gefährlichkeit der Sendung informiert.

We herewith commit ourselves and guarantee that we will indemnify BINDER GmbH for all damages that are a consequence of incomplete or incorrect information provided by us, and that we will exempt BINDER GmbH from eventual damage claims by third parties./ Wir versichern, dass wir gegenüber BINDER für jeden Schaden, der durch unvollständige und unrichtige Angaben entsteht, haften und BINDER gegen eventuell entstehende Schadenansprüche Dritter freistellen.

We are aware that, in accordance with Article 823 of the German Civil Code (BGB), we are directly liable with regard to third parties, in this instance especially the employees of BINDER GmbH, who have been entrusted with the handling / repair of the unit / component. / Es ist uns bekannt, dass wir gegenüber Dritten – hier insbesondere mit der Handhabung/Reparatur des Geräts/des Bauteils betraute Mitarbeiter der Firma BINDER - gemäß §823 BGB direkt haften

Name: _____

Position: _____

Date / Datum: _____

Signature / Unterschrift: _____

Company stamp **/** Firmenstempel:

Equipment that is returned to the factory for repair must be accompanied by a completely filled out contamination clearance certificate. For service and maintenance works on site, such a contamination clearance certificate must be submitted to the service technician before the start of the works. No repair or maintenance of the equipment is possible, without a properly filled out contamination clearance certificate.